The Use of Mobile Positioning data to Measure Visitors of a Multisport Events: A Case study of ASIAN Games 2018 in Indonesia[1]

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Abstract:
Indonesia hosted ASIAN Games in 2018, which was the second time after its hosting in 1962. This paper will present the the methodology of measuring visitors to an event as well as their mobility using mobile positioning data. The data is then used as one of data input for economic impact analysis of the multi sport event. Mobile phone data is used since the immigration data can not give the accurate data people visiting the event, while survey need more time and resources and ticket sales also need time to produce and it can not show the mobility of the people before and after the event nor the origin of visitors. Mobile positioning data is used to analyse the mobility of people visiting the Asian Games 2018 in Jakarta and Palembang. The mobility analysis covers number of people by their originated countries or provinces, their movement during the games period, as well as their interests. The mobility data was then submitted as data inputs for further economic analysis using Computable General Equilibrium (CGE) Model, as for policy recommendation aligned with the 2030 Sustainable Development Agenda.

Keywords: Big data analysis, mobile phone data, multisport impact analysis, computable general equilibrium.

1. Introduction:

Indonesia hosted ASIAN Games in 2018, which was the second time after its hosting in 1962. Historical research demonstrates how the events evolved from primitive gathering of people for agricultural or religious reasons to modern type of events, as well as their long history of attracting tourists and establishing host communities as tourist destinations (Sonja Oklobdžija). In line with SDGs Goal 8 (target 8.9: By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products), there is a possibility that the 2030 agenda is achieved through continuous and regular multi-sport events that could attract more tourists to com to our country.

In this paper, mobile phone data is used to analyse the mobility and behaviour of the people that visiting the event. Mobile positioning data is used since the immigration data can not give the accurate data people that visiting the event, immigration data can only showed people that come to entry gate (airport/port). While survey data need more samples and time to obtain the venue that visited, time and resources and ticket sale also need time to produce and it can not showed the mobility of the people before and after the event and the origin of the people that visiting the event.

The point of interest that will be analysed is the mobility of people visiting the venues of Asian Games 2018 in Jakarta and Palembang, the two cities that held the Asian Games 2018. The mobility analysis covers number of people by their originated countries or provinces, their movement during the games period, as well as their interests. The data with other data is then used as input in Computable General Equilibrium (CGE) Model.

The aim of this paper is to present the methodology of using mobile positioning data for measuring number of foreign and domestic visitors to the event; as well as analyzing their mobilityduring the week of Asian Games. Also, how to integrate, combine and calibrate mobile positioning data with other data

(immigration and population projection) to obtain the best and reliable result. The paper will be divided into four sections, the first section present introduction, the next section present methodology and the third section present the result and the last section is conclusion,

2. Methodology:

In this Asian Games analysis, we use mobile positioning data from one Mobile Network Operator (MNO) which has the biggest market share in Indonesia (around 60 percent nationally). Mobile positioning data is used since immigration data can not provide more accurate data on people visiting the event. Immigration data can only show people that come to entry gate (airport/port) Jakarta (Soekarno-Hatta and Tanjung Priok) and Palembang (St. Badarudin II), and cannot detect whether they come to the Asian Games venues during their stay. Meanwhile, survey data can not provide information on which venues and how often the venues were visited , tickets sales also need time to produce and it can not showed the country of resident and the mobility of the people before and after the event and the origin of the people that visiting the event.

2.1 Foreign visitors

Foreign visitors' mobile positioning data were retrieved with the following methodology. First, the point of interests (venues) and the time/period of observation were decided and delineated. The venues here is the places of all the the Asian Games 2018 events such as Geora Bung Karno (GBK), Taman Mini, JIEXPO in Jakarta and Jakabaring Sport City in Palembang and other venues. Then, we decided the radius around the venue as the area (polygon). While the time of observation period are from 1 August 2018 to 8 September 2018. After that, foreign visitors that come to Jakarta or Banten (Sukarno-Hatta Airport) and Palembang (Sutan Badarudin II Airport) is tracked whether they visited the Asian Games 2018 venues and other places before and after the Asian Games 2018, the length of stay of the foreign visitors was also monitored.

Since the MPD was sourced from one MNO, the data inference was undertaken to estimate the population. The data was calibrated with daily immigration data for every country of origin from Sukarno Hatta, Tanjung Priok and Sutan Badarudin II entry gate. The coefficients of estimation are the ratio of immigration data and mobile positioning data for every country of origin. With this method, it can be obtained the total number of foreign visitors during the Asian Games 2018 in each venue of Jakarta and Palembang (unique and non uniqeu numbers). It can also be obtained the number of foreign visitors daily, length of stay of the foreign visitors, country of origin of the foreign visitors, as well as where they go before and after the Asian Games 2018.

2.3 Domestic visitors

Domestic visitors' mobile positioning data were retrieved with the same methodology as foreign visitors'. The difference was only on the data used for calibration process. First, the point of interests was decided and delineated, and the time or period of the research was determined. The time of observation period for domestic visitors were from 10 August 2018 to 2 September 2018. The mobility domestic visitors were also tracked to get information on their visits before and after the Asian Games 2018 was held. Since the MPD was sourced from one MNO, the data inference to estimate the population was undertaken using weight obtained from domestic tourism household survey. With this method, a lot of important information can be retrieved, such as: the number of domestic visitors during Asian Games 2018, particularlyin Jakarta and Palembang (unique IMSI), number of domestic visitors daily, length of stay in the hosts city (Jakarta and Palembang), the origin of the domestic visitors (municipality/city level), and where do the go before and after the Asian Games 2018 (municipality/city level).

3. Result and Discussion:

3.1 Analysis of Foreign and Domestic visitors and their mobility
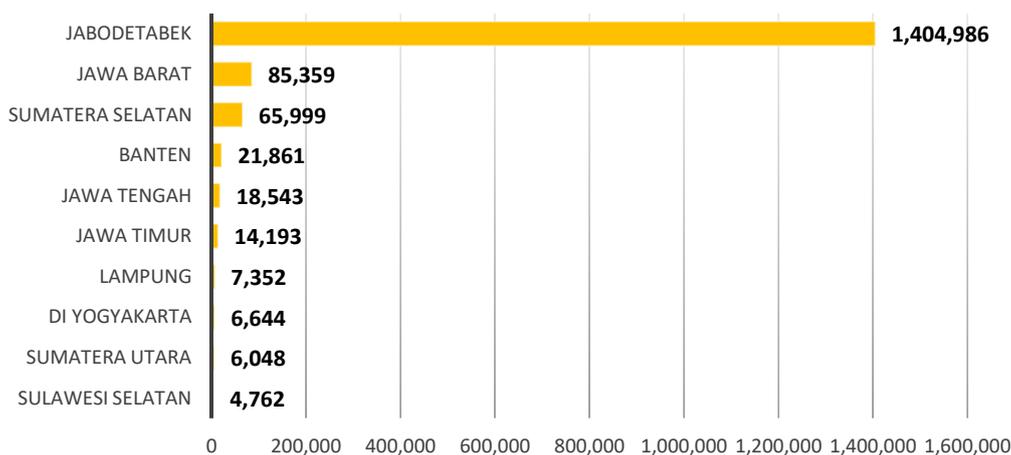
During Asian Games 2018, number of foreign visitors were 78,854 people with total visits to the venues were 267,141 visits. This means, the average visits of foreign visitors to the Asian Games 2018 venues were 3-4 times. While total domestic visitors 977,866 people with number of visits to the venue 1,677,889 visits. This means, the average visits of domestic visitors to the Asian Games 2018 venues were 1-2 times. Ten countries with the highest visitors to Asian Games were China, Japan, Korea, Malaysia, India, Saudi Arabia, Thailand, Singapore, Netherlands, and Philippines. This is actually the same as the medal rank. Picture 1 showed the number of foreign visitors to Asian Games 2018
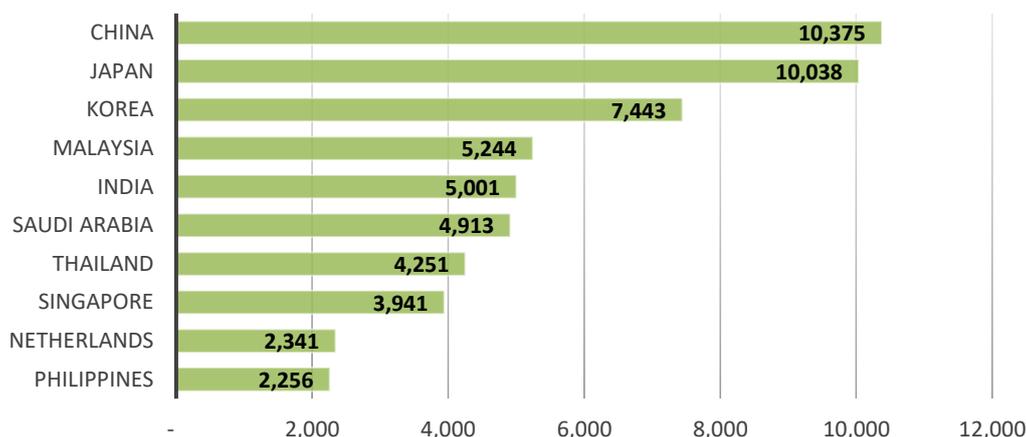
Picture 1.: Foreign Visitors to Asian Games 2018 (number of people)

Domestic visitors to Asian Games 2018 were mainly from Jabodetabek (Jakarta Greater Area), they are 1,404,986 visits from Jakarta Greater Area or 84 percent of total domestic visits. West Java and South Sumatera were in the second and third place with 85,359 and 65,999 visits. Picture 2 showed the number of visits of domestic visitors to the Asian Games 2018.

Picture 2.: Domestic Visitors to Asian Games 2018 (Number of Visits)

India, China, Netherlands and Singapore are foreign visitors with the longest length of stay. On average, they stayed in Indonesia for 17, 16, and 15 days. While, for domestic visitors, people from Lampung, DI Yogyakarta and North Sumatera have the longest stay during Asian Games 2018, they stayed for 1,6 days. Domestic visitors length of stay, on average, 1-2 days.

Length of Stay of Foreign Visitors (days)

INDIA	17
CHINA	16
NETHERLANDS	15
SINGAPORE	15
PHILIPPINES	13
SAUDI ARABIA	11
JAPAN	11
MALAYSIA	11
KOREA	11
THAILAND	10

Length of Stay of Domestic Visitors (days)

LAMPUNG	1.6
DI YOGYAKARTA	1.6
SUMATERA UTARA	1.6
SULAWESI SELATAN	1.5
JAWA TIMUR	1.5
JAWA BARAT	1.5
JABODETABEK	1.5
JAWA TENGAH	1.4
BANTEN	1.4
SUMATERA SELATAN	1.3
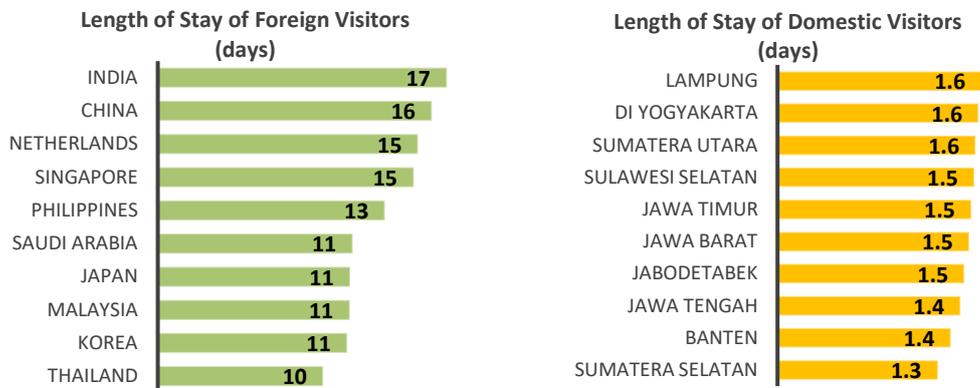
Picture 3.: Length of stay of Foreign and Domestic Visitors to Asian Games 2018 (days)

What is more, using mobile positioning data we can also know other places that are visited (before and after) by foreign visitors of Asian Games 2018. Between 1 July to 8 September, other cities that mainly visited by foreign visitors beside Jakarta and Palembang were Bandung (West Java), Banyuasin (South Sumatera), Pontianak (West Borneo) and Padang (West Sumatera). While during 26 August to 8 September, other cities that visited by foreign visitors are Banyuasin (South Sumatera), Badung (Bali) and Batam (Riau Island).

26 Agustus 2018 – 8 September 2018

BANYU ASIN
BADUNG
B A T A M
KARAWANG
BANDUNG
CIANJUR
MEDAN
MAKASSAR
PADANG
SERANG

1 Juli 2018 – 8 Sep 2018

BANDUNG
BANYU ASIN
PONTIANAK
PADANG
MEDAN
KARAWANG
MAKASSAR
B A T A M
BANDAR LAMPUNG
BADUNG

Picture 4.: Other places that visited by foreign visitors before and after Asian Games 2018

3 September 2018

Other destinations for Asian Games visitors out of a 1000 people
Destinations exclude: Jakarta, Palembang, Bekasi, Tangerang, Depok, Bogor

- 1-5
- 6-10
- 10-125
- Asian Games locations

OpenStreetMap, Carto (2018)

0   100 km

Picture 5.: The mobility of Asian Games 2018 foreign visitors on 3th September 2018

From the daily visits, it can be seen that Gelora Bung Karno (GBK) is the Asian Games 2018 venue that mainly visited with the peak on 1 September 2018, one day before the Closing Ceremony.
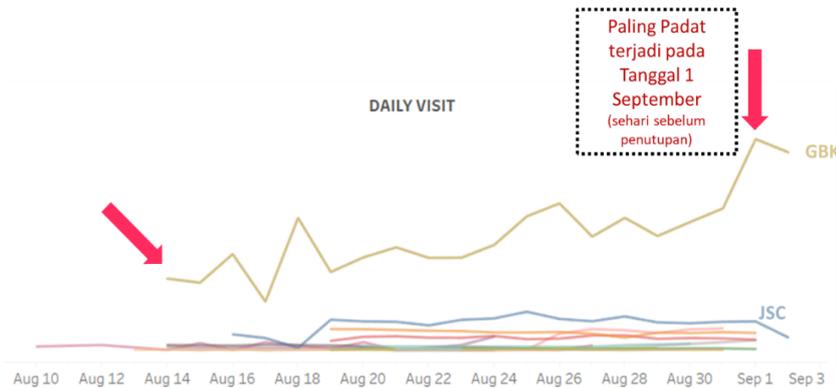
Picture 5.: Daily visits to several venue of Asian Games 2018

3.2 Analysis the Economic Impact of Asian Games 2018
As mentioned earlier, the mobile positioning data is a powerful data source to provide information on people mobility and origins durig the Asian Games 2018. However, there is a further potential use of MPD when it is integrated with other data source and used as data inputs for Computable General Equilibrium model to measure the impact of Asian Games 2018 to Indonesia's economy as well as local economy (DKI Jakarta and South Sumatera economy)..

4. Conclusion and Recommendations:

This paper shows that mobile positioning data is a powerful data source for tracking, analyzing, and monitoring people mobility; while conventional data sources will not be able to provide such information. This paper used mobile positioning data to get number of foreign and domestic visitors and their mobility (places of visits), . the country of origin of foreign visitors, as well as home (city/municipality) origin of domestic visitors. The use of MPD for event analysis is beneficial, as it is complementary to conventional data sources. Further use of MPD in event analysis is to support data inputs – along with other data needed –for economic simulation using Computable General Equilibrium model, from which the policy recommendation will be developed.

The results showed that foreign visitors are mainly from China, Japan and Korea. However, visitors from India stayed 17 days, which is the longest stay compared to other countries. Foreign visitors also visited other places in Indonesia, before and after the Asian Games 2018. Places that they visited were Kemaro Island in Banyuasin, Badung in Bali, and Batam in Riau Island. While for domestic visitors, they are mainly from Jakarta Greater Area (Jabodetabek).

Learning from the past of Asian Games multi sport event, it is important to note that a country need to do advanced preparation of tour package that is aligned with flight connection to maximise the number destinations visited an to create higher multiplier effects to the economy.

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