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Visualization of Data on Earthquake Prone Areas from the Analysis of Earthquake Data Vibrations

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Abstract

The earthquake is a natural disaster that often occurs in Indonesia recorded 50 times in 2019 which is the largest contributor to losses both houses, public facilities, and the second casualties after the tsunami. The cause of the many losses from earthquakes is the detection and notification, as well as earthquake monitoring is still relatively slow, by using earthquake vibration data we can analyze earthquake-prone areas from indicators of magnitude, frequency, depth, as well as the risk of loss if affected by a disaster especially the earthquake in this study required a data house design to do ETL (Extract, Transform, Load) using Pentaho data integration which transforms data into OLAP then vibration data is analyzed using Fuzzy Topsis method to determine earthquake-prone areas then data is displayed using Desktop Tableau provide information to the regional service to find out earthquake-prone areas and the risk of losses to be monitored, overcome and early notice to the public.

Keywords: *Earthquakes, ETL, Pentaho Data Integration, OLAP, Fuzzy Topsis, Tableau Desktop*

1. Introduction

Indonesia is an archipelago located at latitude 07 ° NU - 12 ° S and longitude position 95 ° E - 141 ° E also flanked by 2 oceans namely the Indian Ocean and the Pacific Ocean and 3 tectonic plates namely Indo-Australian plate, Indo Eurasia, and the Pacific plate. Therefore, Indonesia has the potential of natural resources both sea and land as well as a fertile tropical climate as well as a market because it is flanked by 2 continents, in addition to that potential Indonesia also has a large natural disaster potential with total natural disasters recorded by the national natural disaster management agency there are 5,437 disasters natural happens.

Earthquakes are a natural disaster that often occurs in Indonesia 50 times in 2019 but the biggest contributor to losses in both facility homes, and second lives after the tsunami. The cause of the many losses from earthquakes. detection and notification, as well as earthquake monitoring, are still relatively slow,

By analyzing and visualizing earthquake vibration data, we can obtain information that can be used by regional agencies to provide early warnings to the community if the area is earthquake-prone areas and also the risk of loss from the disaster.

2. Research Methods

In this study the research methods and data processing are based on the problems and needs that exist from the following framework:

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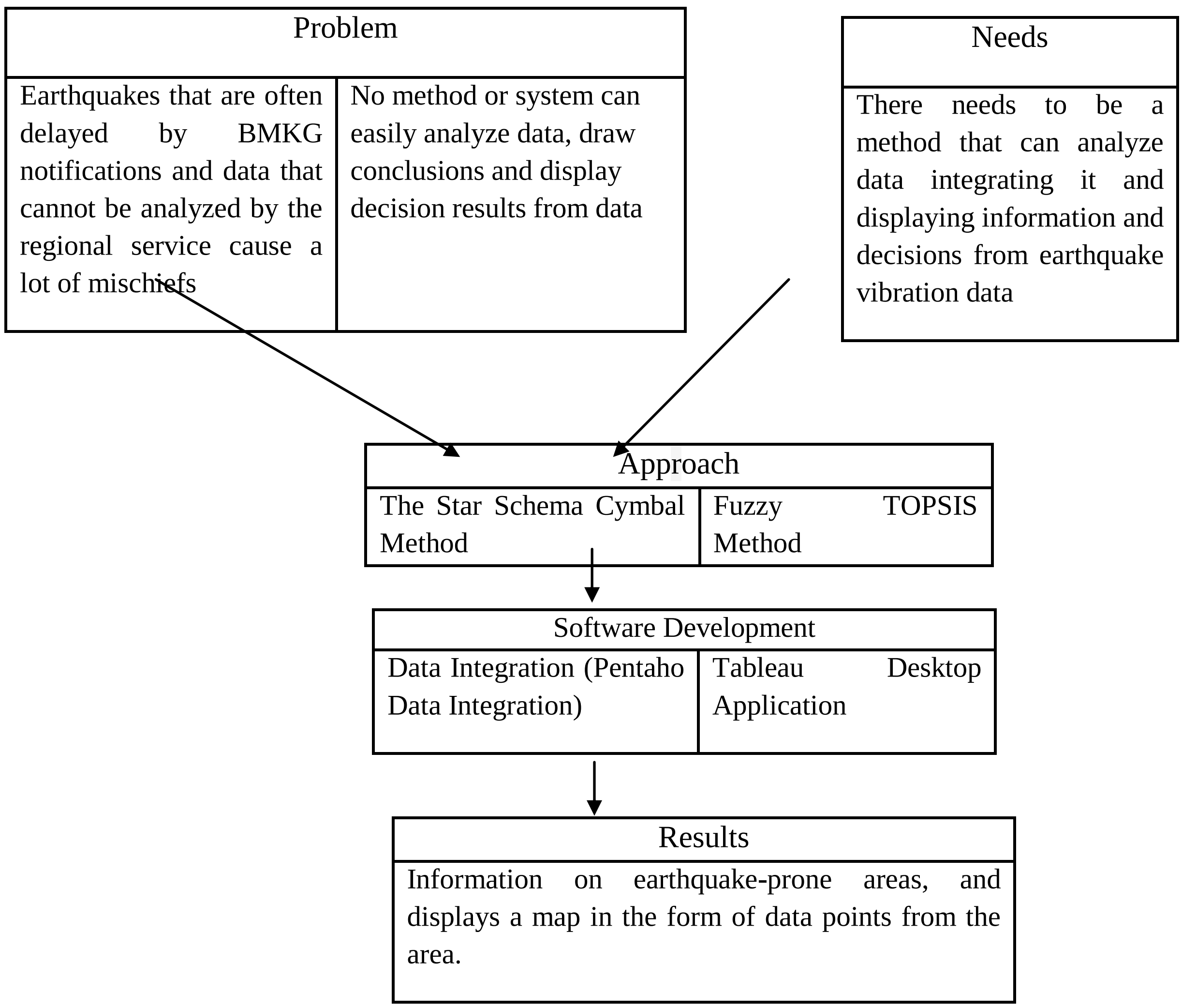

Figure 1. Frameworkfor Thinking

3. Results and Discussion

1. Logical Architecture

In designing logical architecture, the data source that will be used is the source of dataobtained from vibration data that is recorded and provided by BMKG both online and comingdirectly to the center of the station using excel and text file formats. the extraction process,this process is the process of moving data that has been sorted into a database system(MySQL database), data that has been selected will be carried out a transformation process,then the loading process will be carried out, namely the process of entering thetransformation process data into the data warehouse. After the data is in the data warehouse, data analysis can be done through OLAP (online analytical processing) and data can be displayed in the form of a dashboard.

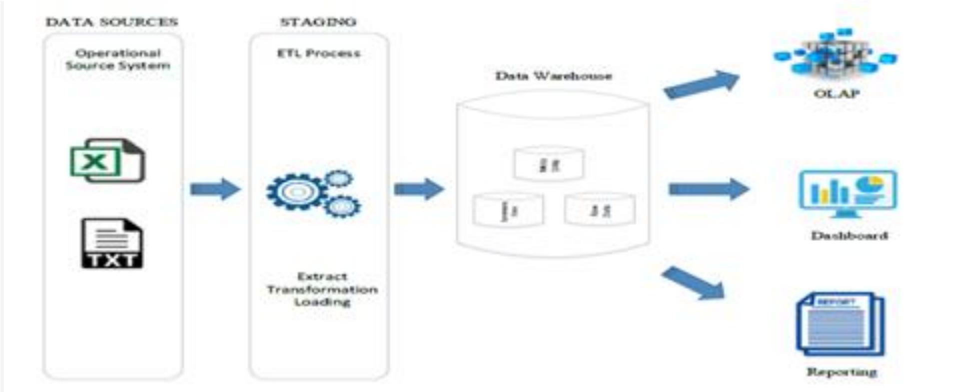

Figure 2. LogicArchitecture Data Flow

4.Architecture

In this study, the data is processed with ETL to create a data warehouse and with MySQL tobe OLAP that has been selected and integrated then analyzed using fuzzy Topsis to determinethe earthquake-prone areas resulting from OLAPand the analysis is then connected to the Desktop Tableau with SHP File views from Indonesia to visualize spatial information onearthquake-prone areas data.

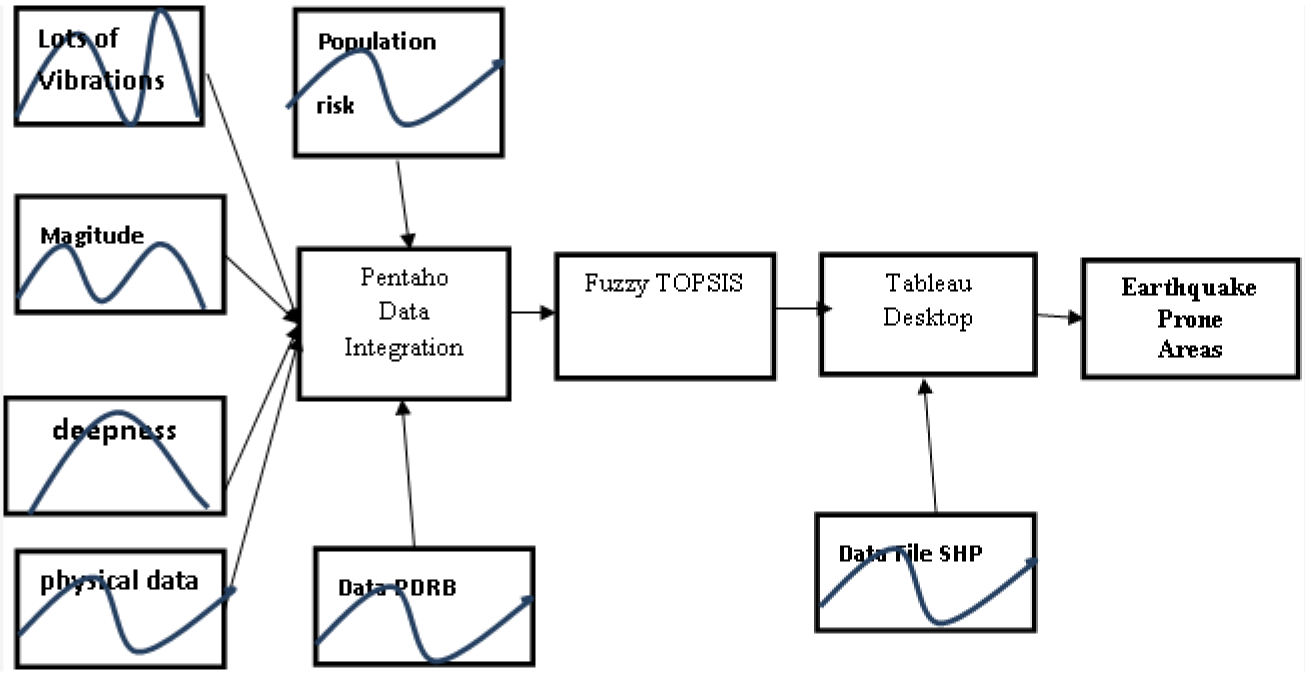

Figure 3. Data flow architecture and tools

5. Data Sources

The data used are data sourced from BMKG recorded from earthquake vibrations byseimographs which can then be downloaded online with excel format, Physical data, Gross Regional Domestic Product, and Population obtained from the central statistical body, datafrom earthquake vibrations require conditioning for determine the regions of latitude andlongitude and then the frequency of each regional ID as below.

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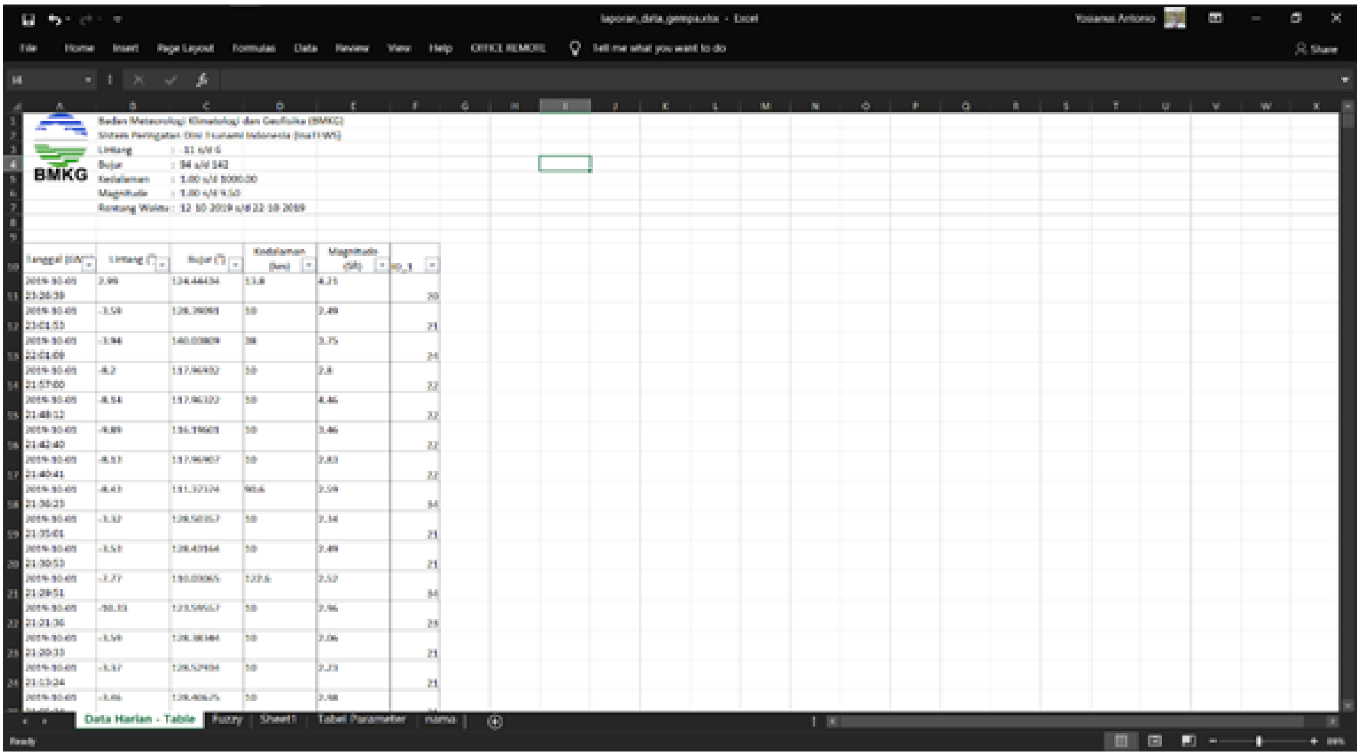

Figure 4. Data Sources

6. Data Staging

The data used must be integrated and selected, therefore a place for selecting and integrating the data is called the staging area.

a. Extractprocess
The extraction process in this research is a process carried out in which from earthquake vibrations using the excel database format and regional name data to integrate so as to produce areas from the location of earthquake vibrations, also on the GRDP data, Physical, and population after that data will go through a processETL for that data can be loaded into SQL format.

b. Transform Process

The transformation process is a process that can change the incoming data inaccordance with the data needed in the data warehouse and in accordance with user requirements. The transformation process is carried out after the extract process, inthis process the selection and merging of the data are carried out to obtain a summaryof the data in accordance with the dimensions to be made. The transformation processuses Pentaho Data Integration.

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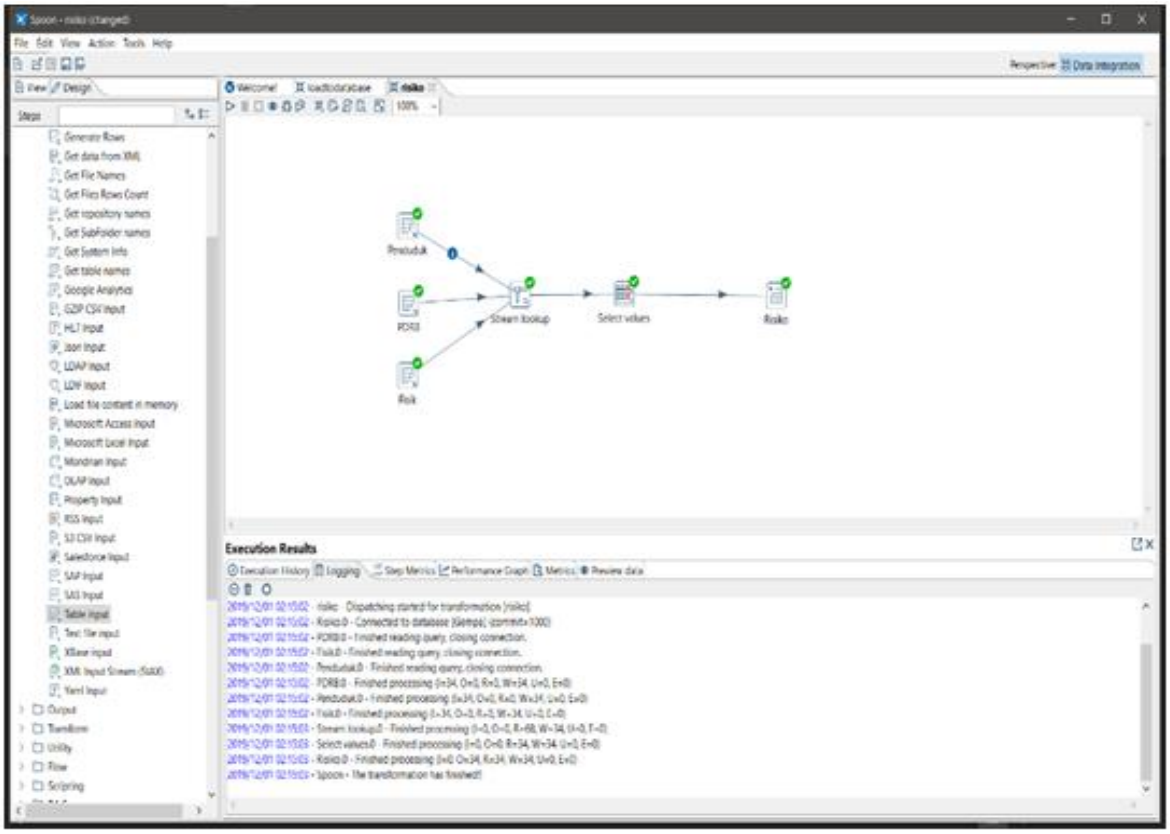

Figure 5. Extract and Transform

c. Loading Process

The loading process is the final stage in the ETL process. This loading process is aprocess whose data is obtained from the results of transformation into a datawarehouse. This loading process can be done by running The SQL script and can be done periodically.

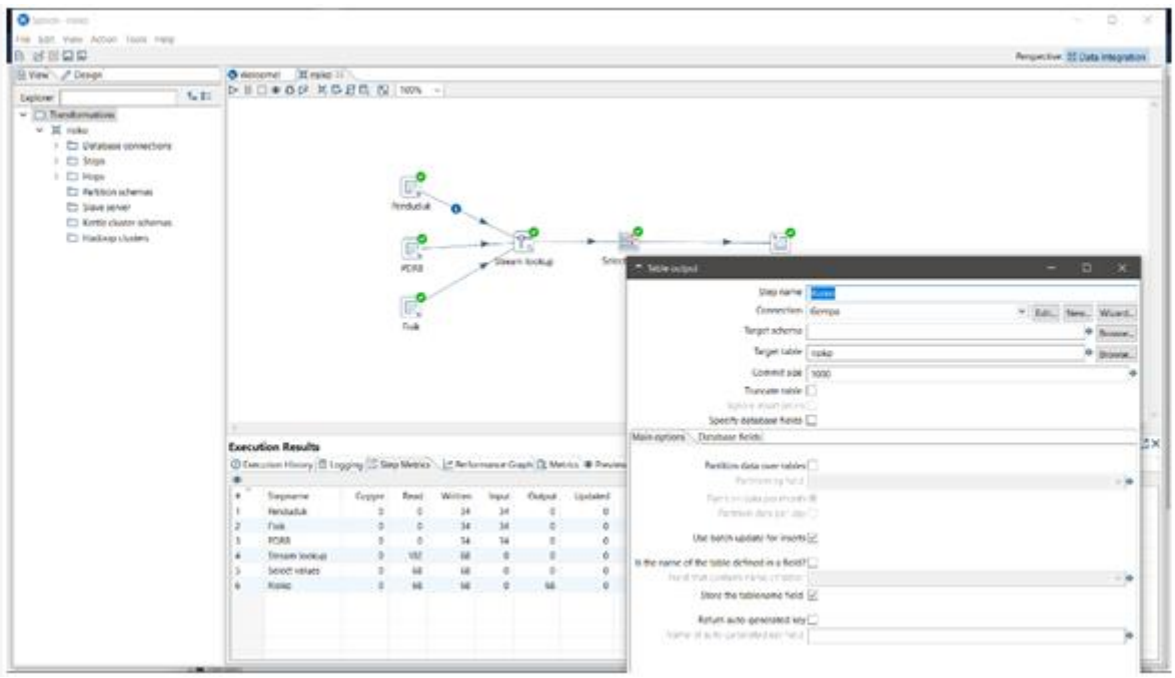

Figure 6. Load

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7. Star Schema

It is a method used to manage data houses, the technique used is Dimensional Modeling, in dimensional modeling using 2 types of tables, namely fact tables, and dimension tables and in this study using 1 fact table and 4 dimension tables.

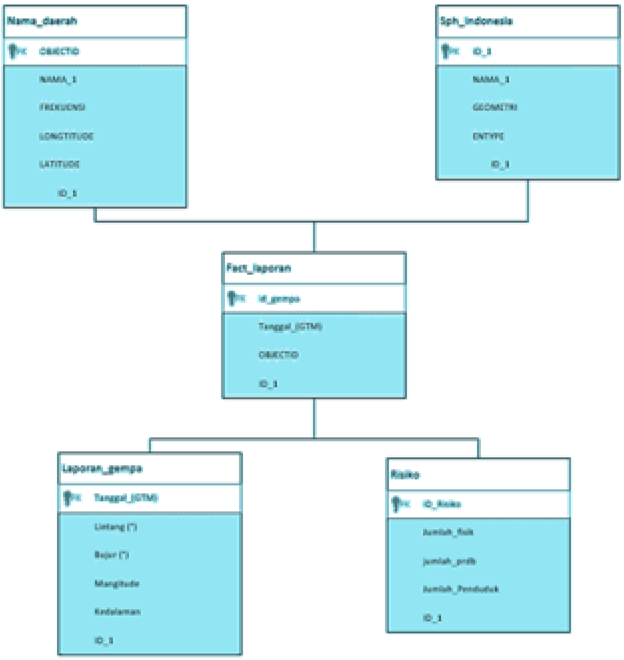

Figure 7. Star Schema

8.Dashboard

The dashboard for displaying data using Tableau Desktop to provide information inthe form of a bar chart, a map of data analysis that is easily understood by the localoffice that sees the information.

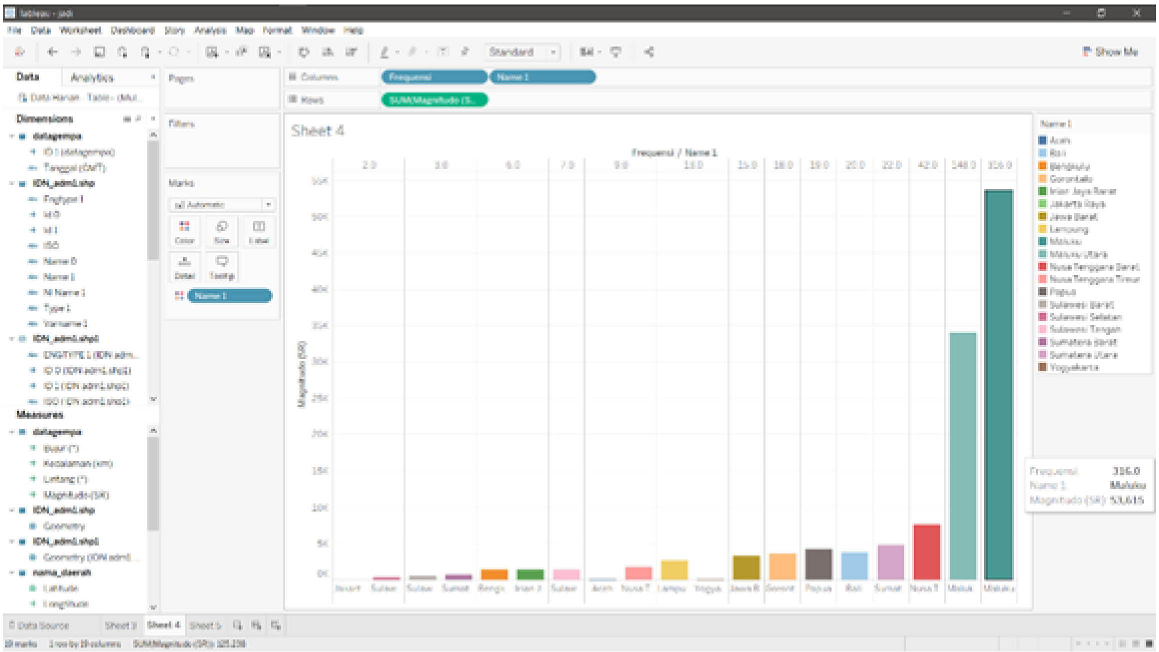

Figure 8. Information on earthquake-prone bars

a. Loss risk information

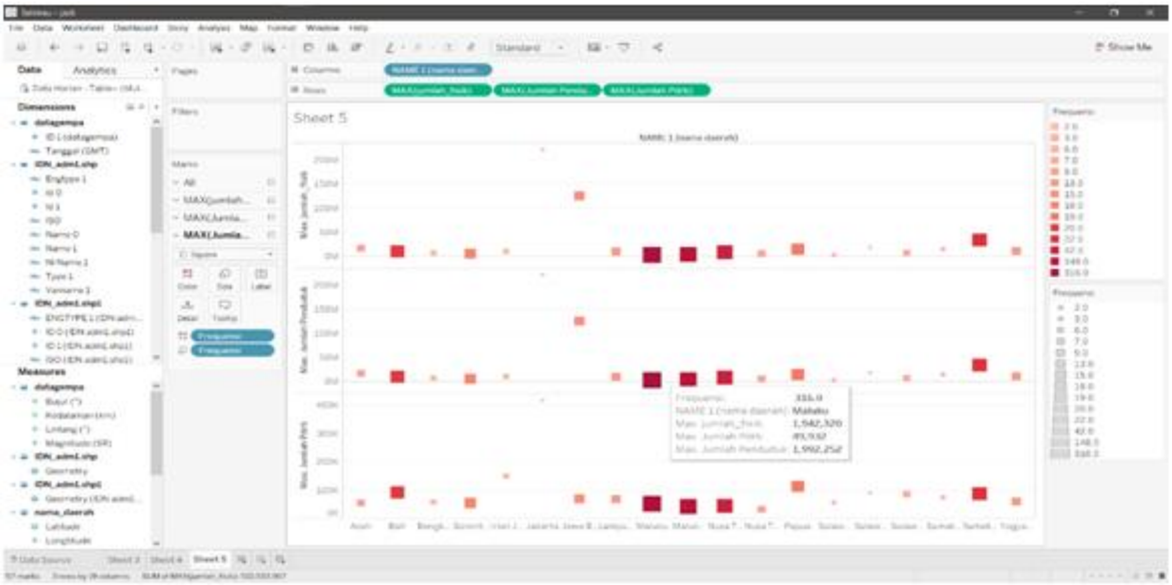

Figure 9. Information on risk of loss

In Figure 9 we can see from 3 sectors which are indicators of losses, namely population (casualties), physical (houses, and public facilities), Gross Regional Domestic Product (GRDP), the amount of regional income from land, industry, and others. In the information above we can see the area that has the greatest risk of loss if exposed to natural disasters without prior notice is West Java, but the data used in this study from the date of 01-10-2019 to 31-10-2019 which is an earthquake-prone area is my shame, to be watched and people get an early warning.

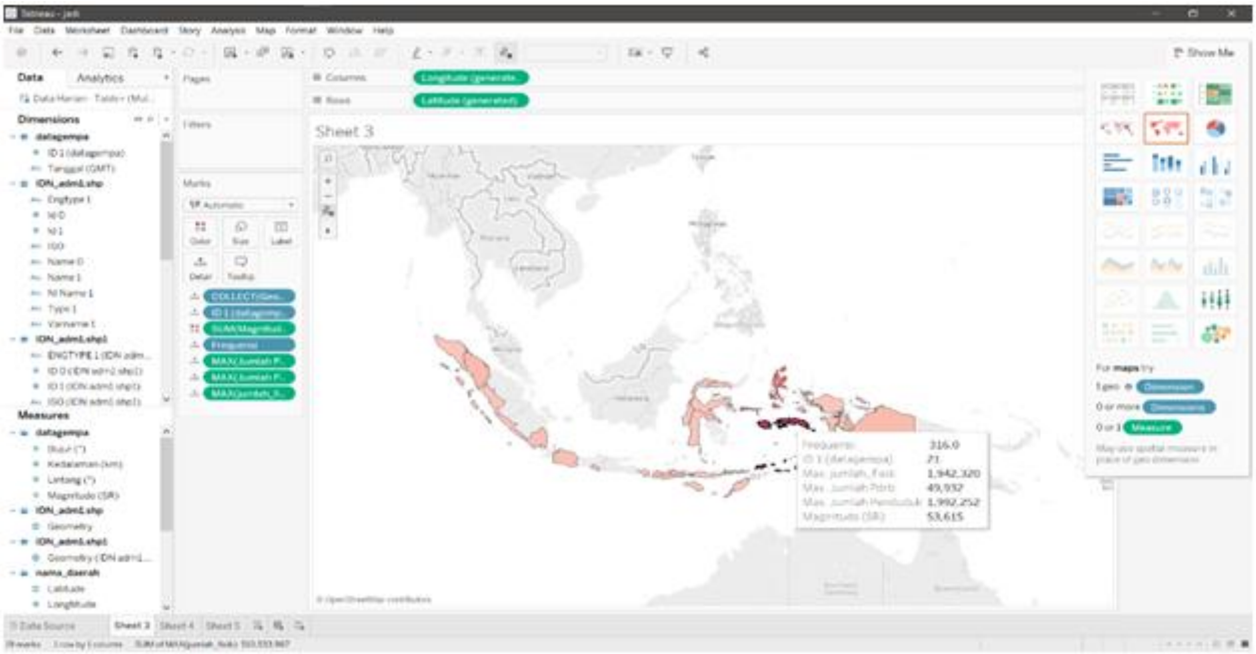

Figure 10. Map of earthquake prone areas

b. Map of earthquake prone areas

In Figure 10 we can see maps of earthquake-prone areas and earthquake-safe areas such as Kalimantan, as well as the level of vigilance from earthquake-prone indicated areas. Here also we can see information from the risk of loss as shown

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above in the province of Maluku, which from this information is the highest earthquake-prone area with a substantial loss threat.

Conclusion

Based on the results of this study, the following conclusions can be drawn:

1. By visualizing data from the earthquake, physical, and pdrb vibration data analysis,residents can provide information that is flexible and easy to understand.
2. This data visualization can provide early warning of earthquake natural disasters fromthe regional service to the community according to the condition of their alert level.
3. And also from the information obtained we can also know the risk of loss that canoccur if it is too late to mitigate natural disasters in earthquakes

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