# Web Geoportal 'BHUMI' for Easy Access to Land Information and Community Participation-Based Mapping

**Dony Erwan Brilianto, Albertus Yogo Dwi Sancoko, Sheilla Ayu Ramadhani, Indonesia**

## SUMMARY

Indonesia has 126 million land parcels, until the end of 2022 there were 100 million land parcels that have been registered – and 15 million of the registered parcels are not yet mapped. The target of 126 million land parcels is expected to be completed by 2025, which means that within 2 years there are 26 million land parcels needed to be registered. To achieve this target, innovations should be taken into place – and using GIS technology (Webgeoportal) is one of the solutions that can be applied. The Government of Indonesia has been making efforts to achieve fully complete land registration in Indonesia – including implementing innovation by developing a web geoportal application called 'BHUMI'. Bhumi is a Web-based application (WebGIS) that displays spatial data – land related that can be accessed digitally. The purpose of developing BHUMI was to provide easy access to land information for everyone and facilitate public information disclosure. Spatial data contained in BHUMI is presented in standard Open Geospatial Consortium (OGC) protocol format, such as Web Map Service (WMS) and Web Map Tile Service (WMTS). The standardized spatial data by OGC is expected to be: Findable (easy to find), Accessible (accessible), Interoperable (can be used on various systems and platforms), and Reusable (can be reused). The public can access information on the registered land parcels in BHUMI, as well as the location information of the Systematic Land Registration Project, the variable value of buying and selling land, and also the forestry boundaries. The community can also rate the quality of the land parcels displayed – the quality of both the spatial data and the information contained.

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## 1. INTRODUCTION

By the end of 2022, 100 million land parcels have been registered out of 126 million land parcels in Indonesia. It is targeted that the whole land parcels (± 126 million land parcels) can be registered by 2025, thus an estimated 26 million land parcels are still needed to be registered within 2 years. To increase the acceleration of land registration, the government through the Ministry of Agrarian Affairs and Spatial Planning (ATR/BPN) has launched a National Priority Program in the form of Acceleration of Complete Systematic Land Registration (known as PTSL). PTSL is a first-time land registration, where the process is carried out simultaneously and covers all land registration objects that have not been registered in the context of a village or sub-district area. The PTSL method is a government innovation to meet the basic needs of the community. The program is outlined in Ministerial Regulation number 12 of 2017 concerning PTSL.

Looking back at the beginning of 2017, Indonesia succeeded in registering 5.2 million land parcels – exceeding the given target of 5 million land parcels. This was well achieved through good cooperation between Ministries, service, and technology innovation, as well as massive involvement and participation of the community. One of the channels involving the community to actively participate in land registration activities is using WebGIS technology. WebGIS or geoportal is an ideal platform to disseminate spatial information within the institutional scope of work. A geoportal is a gateway to web-based geospatial resources, enabling any geospatial information and services to be published, discovered, viewed, and also accessed by their providing organizations (ESRI 2021). Likewise, data providers can also use the geoportal to make their geospatial resources discoverable, viewable, and accessible to others. Indonesia has published Bhumi WebGIS since 2020 as a realization of Presidential Regulation number 95 of 2018 on Electronic Government Systems, Presidential Regulation number 27 of 2014 on National Geospatial Information Networking, and Presidential Regulation number 39 of 2019 on One Data Policy. This WebGIS is considered to be useful for accessing geospatial data – including land parcel data resulting from cadastral activities.

Currently, the use of Bhumi has not been optimized to assist in accelerating the implementation of land registration. Bhumi is now only functioning as a platform to disseminate information on land parcels. Thus, it is now developed aiming to be able to support the land registration acceleration by adding features and facilitating access to other land information for the community.

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Land information that is currently displayed on Bhumi includes the main information on land administration – where is also taking a role in the government's effort in carrying out land policy. In land administration, there are 4 (four) main elements: land tenure, land value, land use, and land development. Each element of land is managed by several government agencies that work together. Within the scope of regencies/municipalities, the management of each element of land administration is managed, such as land tenure, land use, land value, and land development.
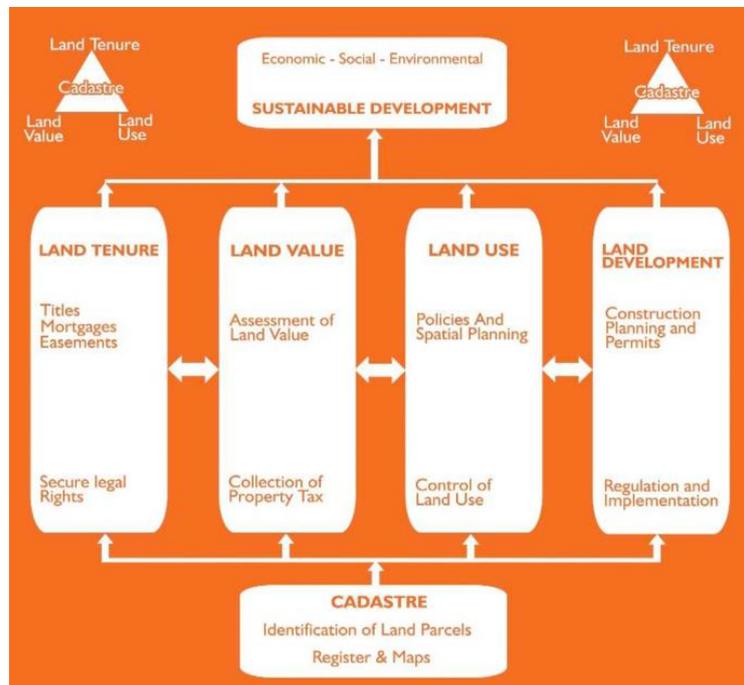


*Figure 1. Global perspective of land administration (Enemark, 2014)*

## 2. WEB GEOPORTAL 'BHUMI'
### 2.1 Land Parcels Data Collection Process

Data on land parcels were obtained from two methods, through routine services, PTSL, and from the results of improving data quality. The mapping process is carried out through 5 stages:
a. Inventory
   At this stage an inventory is made of the existing map data, both analog maps in paper format and digital maps in dwg, dxf, etc.).
b. Vectorization
   At this stage, the format is transferred from analog format to digital format by scanning and then digitizing on screen.
c. Standardization
   At this stage, standardization of digital maps is carried out. Standardization is carried out on layer names, and map projection systems, and then map topology is carried out.
d. Import Map

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Land parcel that has been topologically imported into the geodatabase using GeoKKP tools. Land parcels that have been imported into the geodatabase can already be displayed on the registration map or other channels such as Bhumi.

e.  Map Updating
Land parcels that already exist in the geodatabase are updated if there is a change in data or the addition of attribute data through data entry activities or land services.
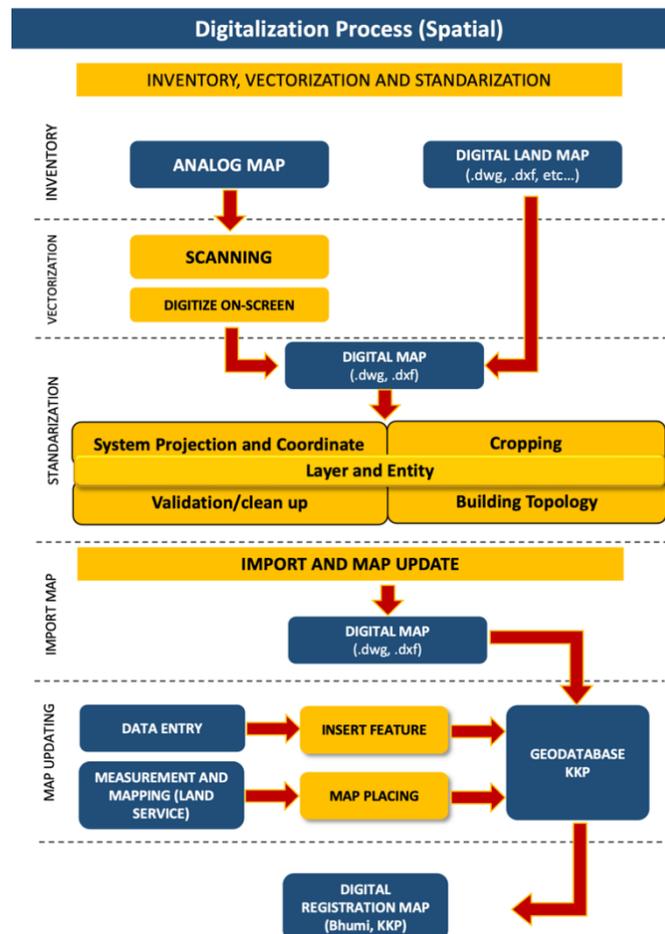


*Figure 2. Land Parcel Data Collection Process*

## 2.2 Tools and Technology

Data documented in BHUMI.atrbpn is data managed by each work unit as a data producer at the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency. The purpose of BHUMI.atrbpn is to provide easy access to authoritative and other spatial data for the community, government, and other institutions and also to facilitate public information disclosure. The spatial data contained in BHUMI.atrbpn is data stored in a database and presented in the standard Open Geospatial Consortium (OGC) format, such as the WMS (Web

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Map Service) protocol. The Bhumi Web Application displays spatial data in the form of WMS (Web Map Service) from two sources:

a. KKP GeoServer directly connected to the KKP database
- Tables identified as spatial tables in the MPA database can be converted to WMS using GeoServer, which is then read and displayed by the Bhumi web application.
- The spatial table itself is a table that has a geometric column so that the information presented is spatial information such as parcels, land value zones, PTSL locations, toponyms, etc.
- The DBMS used to store spatial data in the KKP database is PostgreSQL with support for the PostGIS extension and Oracle with support for the Oracle Spatial extension.

b. Geoserver from Atlas geoportal
- Geoportal Atlas is a web-based data catalog portal that functions to store and present spatial data.
- This Geoportal was developed using the Geonode platform which consists of Geoserver, Database, and web application components.
- The geo-node web application facilitates authenticated users to upload spatial data from various standard OGC formats such as (geojson, shapefile, etc.), style the uploaded spatial data, and provide metadata.
- This web application is developed using the Django framework.
- The uploaded spatial data is then stored in the database component which in this system architecture is stored in the KKP's Postgresql database.
- Spatial data stored in KKPDB is then converted using Geoserver to become WMS.
- The list of spatial layers that have been uploaded to Geonode can be accessed using the Rest API provided by Geonode so that information such as WMS, layer names, metadata, etc. can be displayed on Bhumi.

The front end of the Bhumi Web application is made using the ReactJS framework and styling its appearance using Tailwind CSS. The back end of the Bhumi Web application is built using the NodeJS+Express framework. Maps on the Bhumi web application are made using Maplibre for 2D and Cesium for 3D.

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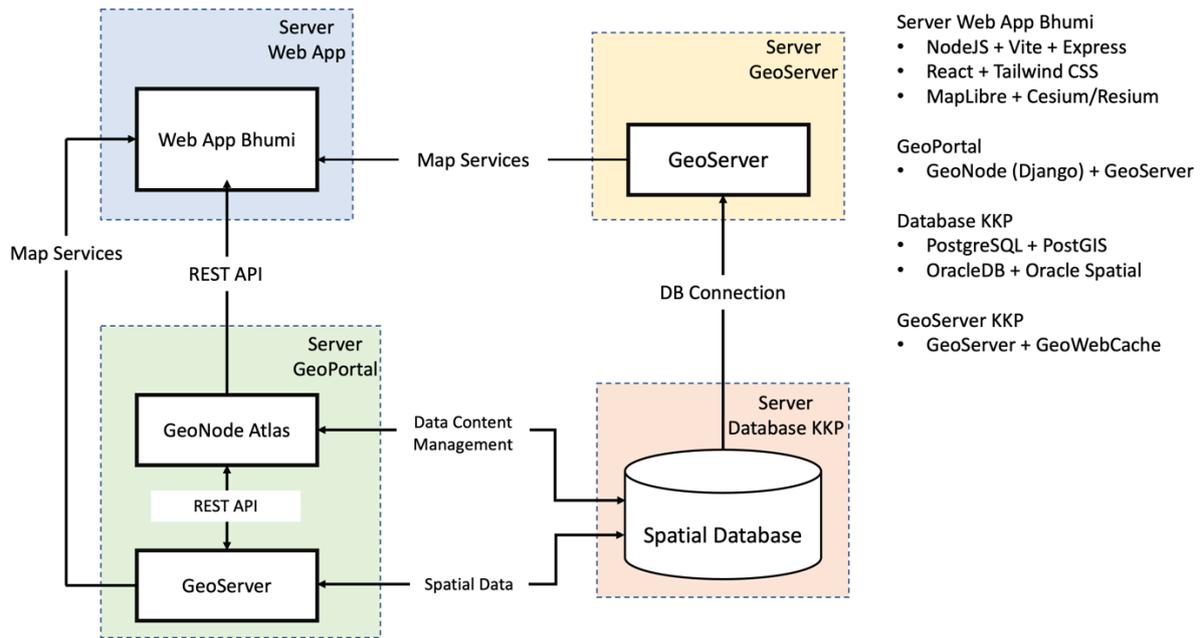Orlando, Florida, USA, 28 May–1 June 2023

*Figure 3. Bhumi Architecture*

## 2.3 Land Tenure

Until the end of 2022, the number of registered land parcels is 101 million land parcels, with the largest number of registered land parcels in Central Java Province at 18.5 million land parcels.
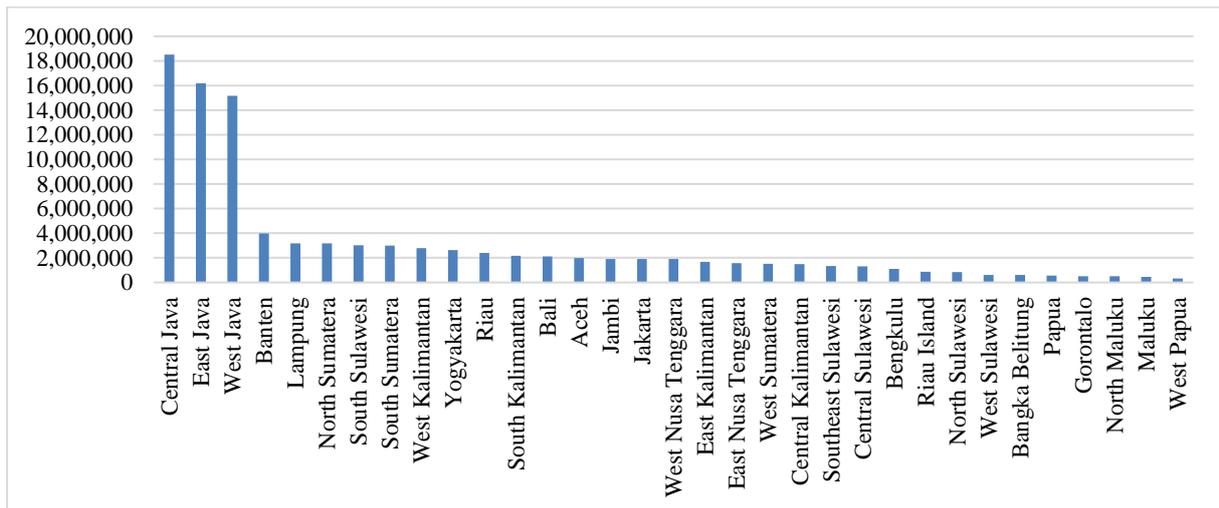


*Figure 4. Total Registered Land Per Province*

The Bhumi WebGeoportal displays land tenure data which can be accessed by the public on the website page https://bhumi.atrbpn.go.id/. Attribute data displayed are land use data, field identification numbers, types of land rights, and land area. The public can also provide ratings

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and comments on the displayed land parcel data. Rating data and comments are very important in improving the quality of land parcel data.
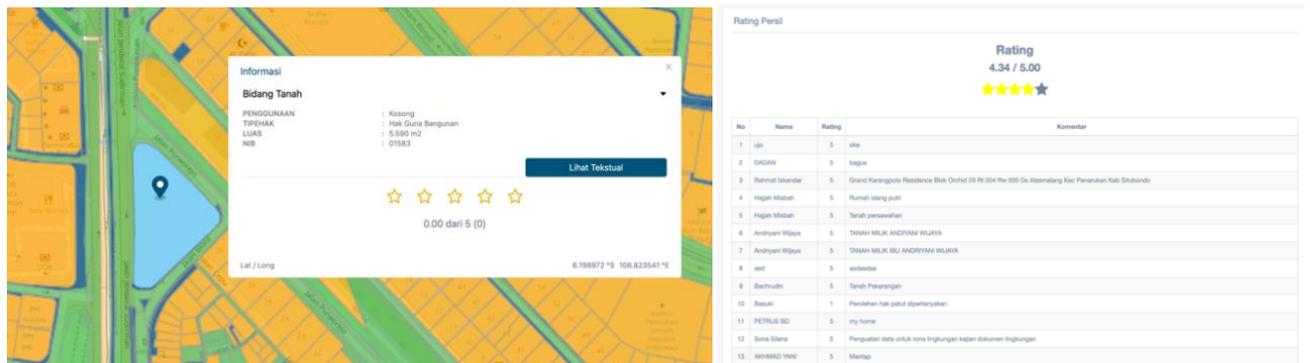


*Figure 5. Land Tenure Information and Rating on Bhumi*

The rating and comment features are quite popular among the users/community, where shows the parcel data on Bhumi has been rated by 230 users with a rating value of 4.3 out of 5, while the Bhumi application itself has been rated by 101 users with a rating of 4.2 out of 5.

### 2.4 Land Value and Land Development Information

The Land Value Zone (ZNT) issued by the Ministry of ATR/BPN is a polygon that describes relatively the same land value from a set of land parcels within it, the boundaries of which can be imaginary or real according to land use. The difference in value between one land and another is based on an officer's analysis using the market price and cost comparison method. The information displayed by ZNT is the value of the land in an "empty" state, not including the value of the objects attached to it. Bhumi provides convenience for the community directly for finding out the value of existing land. In addition, it can be used by stakeholders such as developers, notaries, agencies that require land for land acquisition activities, or by the Regional Government.

Not all regions of Indonesia have a land value map, currently, the area that already has a land value map of 62 million hectares with the province with the widest land value map coverage is Central Java province with 6.8 million hectares.

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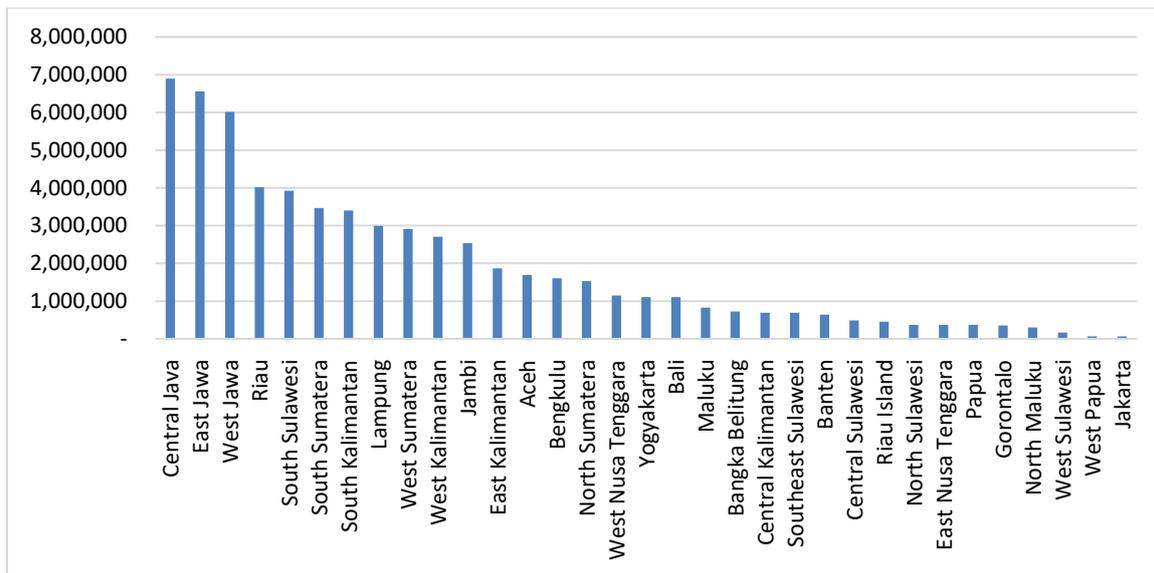Orlando, Florida, USA, 28 May–1 June 2023

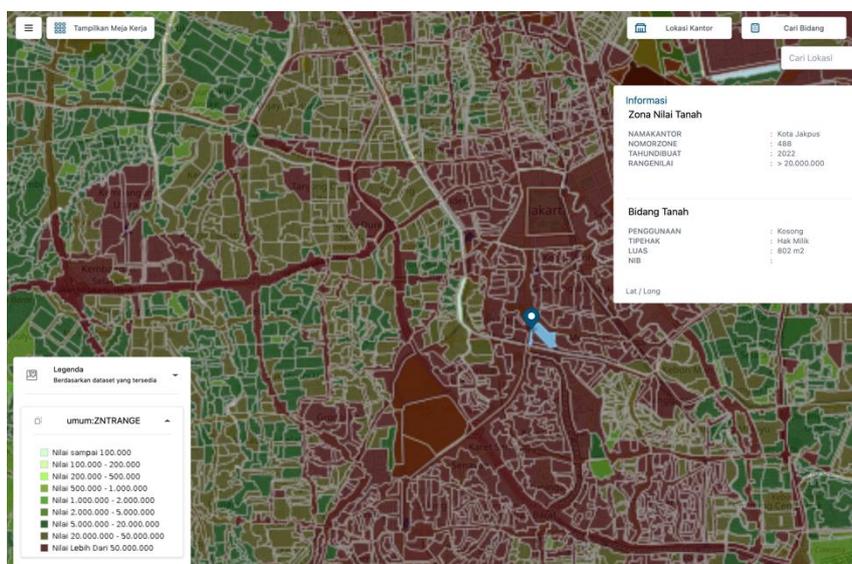*Figure 6. Area of Land Value Map Coverage per Province*



*Figure 7. Land Value Information on Bhumi*

## 2.5 Land Use

Spatial data displayed on Bhumi is obtained through the service of the Directorate General of Spatial Planning. The map displayed is a Spatial Planning (RTR) map from the National level to the District and City levels. In addition, it also displays a Detailed Spatial Plan (RDTR) map. The RTR map that is displayed is by the existing regional regulations. So that it only displays the RTR Map of areas that already have Spatial Regulations.

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*Figure 8. Spatial data displayed on Bhumi*

## 2.6 Atlas Geoportal

One of the features added to Bhumi is a feature for sharing map data using technology from GeoNode. GeoNode is a geospatial content management system, a platform for the management and publication of geospatial data. It brings together mature and stable open-source software projects under a consistent and easy-to-use interface allowing non-specialized users to share data and create interactive maps. Data management tools built into GeoNode allow for the integrated creation of data, metadata, and map visualization. Each dataset in the system can be shared publicly or restricted to allow access to only specific users. Social features like user profiles and commenting and rating systems allow for the development of communities around each platform to facilitate the use, management, and quality control of the data the GeoNode instance contains.

An example of its use is if there are people who want to build a factory and want to know the estimated number of land parcels that must be purchased and the costs incurred for land acquisition, then they can use this feature. He only needs to prepare polygon area of interest data from the factory he wants to build, then upload the data through the Bhumi application and overlay it with other supporting map data so he gets the information he wants.

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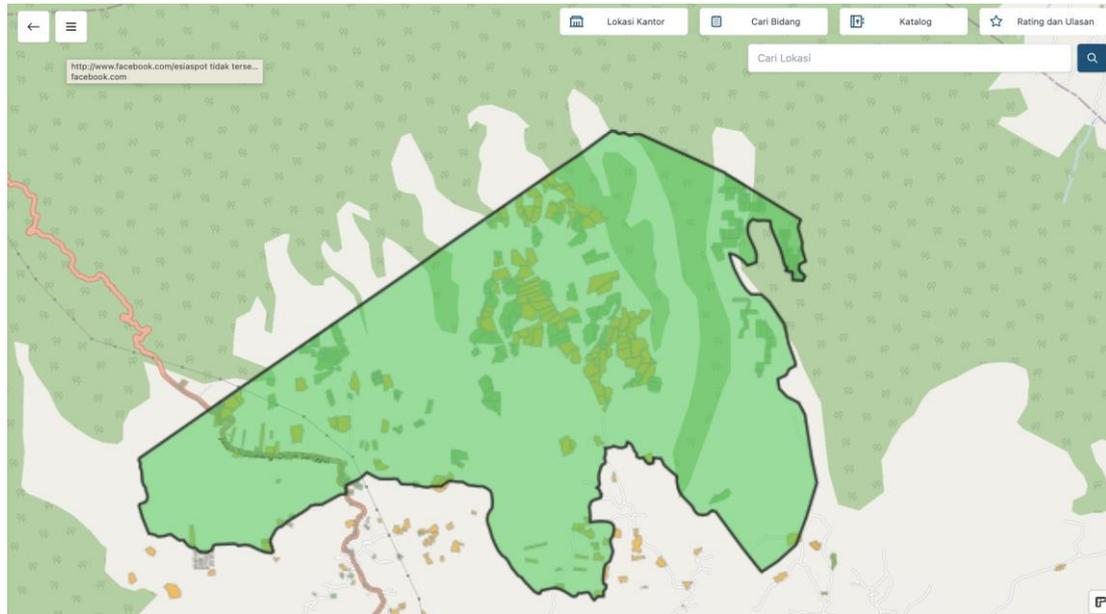Orlando, Florida, USA, 28 May–1 June 2023

*Figure 9. Example of Data Upload on Bhumi*

One of the problems that occurred in the implementation of PTSL was the lack of information on the location of the village that was the target of PTSL to the community. It should be noted that not everyone lives in the village where their land is located, and this has resulted in the low achievement of land registration in the village. One solution is to display village locations that are targeted by PTSL to the community on the Bhumi application. It is hoped that by displaying information on the location of the PTSL target villages, the community will be enthusiastic about registering their land and completing the required data.

In the Bhumi application, what is displayed is the village administrative boundary polygon with attribute data in the form of the name of the province, sub-district, village, and target certificate. Until now, 55.292 villages have been targeted by PTSL, or around 68% of the total villages in Indonesia. Central Java province has the most PTSL-targeted villages with 6.139 villages.

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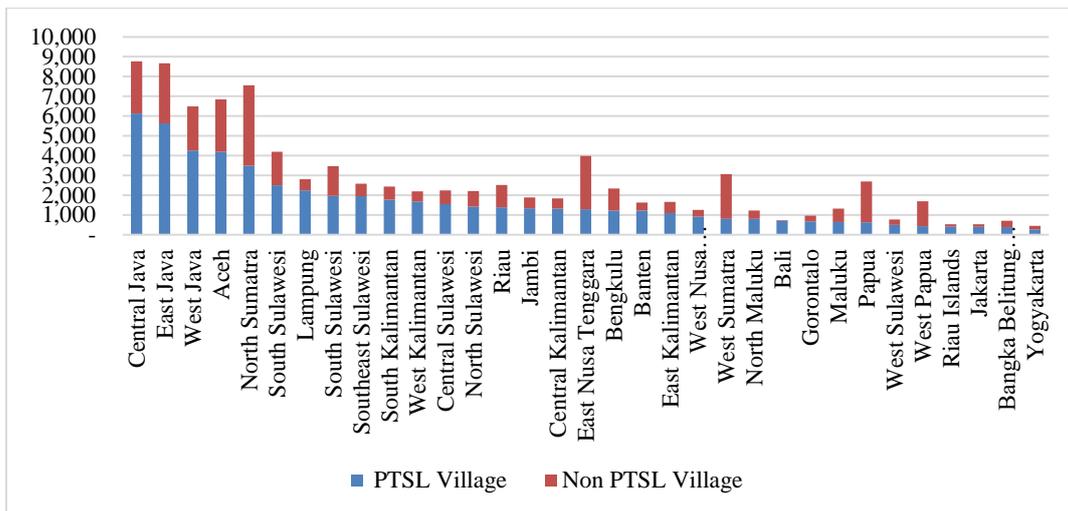Orlando, Florida, USA, 28 May–1 June 2023

*Figure 10. Comparison of villages that have become PTSL targets and those that have not*
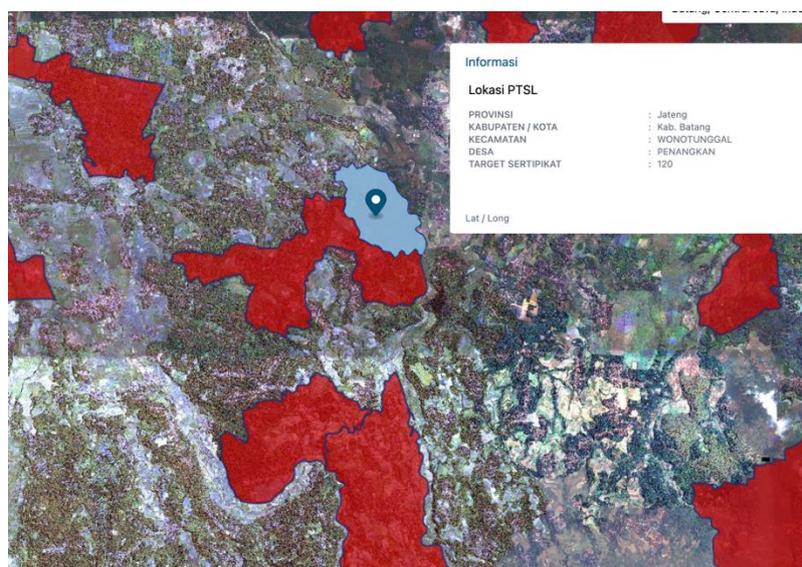


*Figure 11. PTSL Location Information on Bhumi*

### 3. CONCLUSION

Geospatial-based land information shared through Bhumi received a very good response from the community. Based on google analytics data that has been embedded in Bhumi during the period 12-18 February 2023, it was found that the number of users accessing Bhumi was 9,400 users with an average user of 358 users/minute. The location of users with the most access is in the city of Jakarta, followed by the cities of Surabaya and Bandung.

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*Figure 12. Bhumi data analytic*

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## BIOGRAPHICAL NOTES

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