

# Evaluation of Indonesian Land Base Map for Cadastral Application

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**Key words:** Cadastre, Capacity building, Professional practice

## SUMMARY

Land Base Map (LBM) is fundamental as a spatial basis for parcel-based cadastral application such as land registration, land use management, and land valuation. In Indonesia, LBM is produced and maintained by National Land Agency Republic of Indonesia (BPNRI) via Directorate of Base Mapping. The institution produces the maps in certain scales, ranging from semi detail 10K to very detail 1K map. In order to make the production more precise, i.e., can fulfill the need and effectively support what actually needed by BPNRI's land offices (Kantah) and provincial offices (Kanwil BPN) in their public service as cadastral mapping, parcel boundary reconstruction, and land valuation, the directorate conducted an evaluation on its products. It aimed to understand 1) how effective the usage of land base map, 2) among the scales, which more effective, 3) what are the deficiencies of the maps, and 4) what are the obstacles when use the maps. Using purposive sampling approach, the evaluation was chosen to be located in 13 Kanwil BPN and 26 Kantah as sample areas. Then, by analyzing the distributed questionnaires, some statistical analysis was conducted by deploying descriptive statistical analysis, categorization, difference test Kruskal Wallis, importance-performance matrix, and cluster analysis. As results, there was a SWOT analysis of the produced land base maps. This research ended with final conclusion that 1) the larger scale of the maps the more effective they will be used for parcel-based cadastral application, 2) there were classic problems of human resources and capacity building (lack of employees, wrong men in wrong places, lack of professional education and training) that caused inappropriate understanding of how to use the maps effectively according to scale and its operability. Finally, the study provides recommendation containing suggestions how to tackle these problems

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## 1. INTRODUCTION

### 1.1. Background

Land Base Map (LBM) is one of important spatial infrastructure to support Indonesian cadastral programs development and accelerate of assets (i.e, land) legalization, maintain legal certainty of land rights, and reduce land disputes. According to the standard (BPN, 2002) there are three main scales to produce: scale of 1:10.000, 1:2.500, and 1:1.000. In this regard, during 2010-2014 as outlined in BPN RI Strategic Plans, it is expected that base mapping program would be able to provide land base map to support land registration, thematic mapping, land valuation, and other land activities.

Basically, Directorate of Base Mapping that has duties to formulate policy and technical functions, norms, standards, guidelines and mechanisms in the field of surveying and mapping as well as the basic plan and land base mapping program through the use of remote sensing technology based on optical images, has been generating a lot of base map of land with a fairly wide area coverage

Land base maps have been distributed to all Indonesian provinces. From 1985 to 2011 BPN RI has produced maps with coverage of approximately 9.539.025 hectares or 10.60 % of the total target to map (approximately 90 million hectares). This achievement data does not include the results of base mapping process undertaken by BPN Provincial Offices (33 offices) and District Land Offices (443 offices). Although it can be said that there are many produced products, it is still important to evaluate the effectiveness of its usage in supporting land office programs and public services.

Based on this background, Directorate of Base Mapping BPN RI has implemented a project named "Evaluation of Land Base Maps for Cadastral Application". The project was executed for two months. The project was a self-managed project, conducted by the BPN's personnels, and assisted by the experts from external institutions, the Institute for Research and Community Service (LP2M) from National Institute of Technology (Itenas).

### 1.2. Objectives

This evaluation aims to improve the effectiveness of land base maps in supporting land management.

In more detail, the objectives of this activity are:

- 1) To inventory all available types of land base maps in various formats and scales, as

- well as the facilities and infrastructure available
- 2) To identify and assess the effectiveness of the use of land base map, which one more effective is.
  - 3) To identify and assess the various constraints and obstacles from the utilization as well as from the aspect of availability of human resources, infrastructure, and facilities

## 2. METHODOLOGY

### 2.1. Measure and Sampling

There were three types of used approaches (1) a normative approach (based on norms and regulations), (2) a collaborative approach (involvement of related stakeholder), and (3) technical-academic approach (using reliable academic theory). All was combined into single method of analysis.

The measuring instrument was in the form of open questions (filling-in) and closed questions (provided answer choices). The instrument was designed based on the main variables (types, effectiveness, obstacles/constraints). Each variable was then described again to more operational (easily measured). As results there are seven points to measure:

1. The availability of land base maps.
2. The effectiveness of land base maps along with constraints and bottlenecks .
3. The availability of facilities and infrastructure for survey and mapping.
4. The effectiveness in using the facilities and infrastructure.
5. The condition of human resources (land surveyors and map archivists)
6. The availability of facilities and infrastructure for archiving land base maps.
7. The overall management of land base maps.

Analysis unit (samples) that were studied were:

1. Division for Survey and Mapping at BPN Provincial Office (Kanwil BPN Provinsi). A respondent for this analysis unit was the Division Chief or a senior staff.
2. Section for Survey and Mapping at Land Offices in Regencies or Municipalities (Kantah). A respondent was the Section Chief or a senior staff.

We used area-based purposive stratified sampling method. Stratified sampling divided the population into groups (Singarimbun et al, 2010). Members in the group have the same characteristics. In this study the population was divided into 2 groups: BPN Provincial Offices and BPN Land Offices. Sampling area was divided into several areas or regions. Samples were taken from each region. In total there were 39 samples consisting of 13 BPN Provincial Offices, 13 BPN Land Offices at 13 Municipalities, and 13 BPN Land Offices at 13 Regencies. Kantah District. Table 1 shows the samples location:

**Table 1. Samples**

Areas	Provinces	Municipalities	Regencies
<b>Western</b>	Sumatera Utara	Medan	Deli Serdang
	Sumatera Barat	Padang	Padang Pariaman
	Sumatera Selatan	Palembang	Ogan Komering Ilir
	Bangka Belitung	Bangka Barat	Bangka Selatan
	Jawa Tengah	Semarang	Semarang
	Jawa Timur	Surabaya 1	Gresik
<b>Middle</b>	Nusa Tenggara Barat	Mataram	Lombok Barat
	Nusa Tenggara Timur	Kupang	Kupang
	Kalimantan Selatan	Banjarmasin	Barito Kuala
	Sulawesi Selatan	Makassar	Maros
	Gorontalo	Gorontalo	Gorontalo
<b>Eastern</b>	Maluku	Ambon	Maluku Tengah
	Maluku Utara	Ternate	Tidore

## 2.2. Method

We collected primary and secondary data. Primary data were collected through questionnaires, interviews, and field observations. We conducted validity and reliability test for the questionnaires. Afterwards, the data were processed using several methods of analysis (statistical/quantitative and qualitative):

1. Descriptive statistics  
Used to calculate the percentage of respondents who answered particular options to understand BPNRI's offices profile.
2. Categorization  
Categorizing the offices and indicators into high, medium, and low category.
3. Data transformation  
Transforming ordinal data to interval data by using successive interval.
4. Normality test  
Using goodness of fit method to make the data will be distributed normally for further

- analysis.
5. Kruskal-Wallis test different  
Conducted to analysis the characteristic difference among samples categories (Provincial offices versus Land Offices, Indonesian Eastern versus Western Part). We were using ordinal data and more than two samples so Kruskal Wallis method was deployed. Statistical software SPSS was used.
  6. Importance Performance Matrix (IPM)  
The matrix would be useful for us to make priorities when conducting steps to increase the effectiveness of land base map usage.
  7. Cluster analysis  
The analysis was important to analysis the similarity of the group of samples based on their characteristics.
  8. SWOT analysis.  
Useful for making recommendations (Rangkuti, 2010).

### 3. ANALYSIS

After operated the statistical analysis, wethen analyzed the strengths, weaknesses, opportunities, and challenges (SWOT) of land base use map utilization as presented in Table 2 below.

**Table2. SWOT analysis**

<i>Strengths (S)</i>		<i>Weaknesses (W)</i>	
1.	BPN head quarter (BPN RI) has provided land base map in various types, formats, and scales for the purposes of Kanwil dan Kantah.	1.	Land base maps provided from BPN are not encompass the entire service territory and need updating for certain areas so in fact the Kanwils and Kantahs are using alternatif base map from other sources.
2.	All Kanwils and Kantahs offices has already using land base maps for parcel delineation and other uses (thematic mapping).	2.	In several aspects, the quality of land base map provided BPN are not standard (scale, resolution, processing process).
3.	There is high motivation of BPN's human resources to use land base map and improve technical self-competence	3.	Not all alternative base maps from other sources are complying with the BPN standard.
4.	The implementation of Geo-KKP policy has motivated leaders and staff to utilize land base map in land parcel mapping.	4.	Lacking of BPN's human resources who have adequate educational background, trainings, and functional position in working with land base maps for public services.
5.	All Kanwils and Kantahs already have infrastructure for surveying, measuring, and mapping.	5.	Old people employees. Around half of survey and mapping staffs are more than 40 years old.
6.	All Kanwils and Kantahs already have infrastructure for archiving land base map.	6.	Lacking of survey and mapping facilities and infrastructure
		7.	Lacking of archiving facilities and infrastructures in Kanwils and Kantahs.
		8.	Limited and unstable internet connection to operate web-based Geo-KKP.
		9.	Unstable electricity power in the offices (would disturb the computers and equipments)
		10.	Development of knowledge and expertise as well as the placement of employees have not been programmed properly.
		11.	Land base map inventory and archiving have not done well.
		12.	There is undistributed and socialized land base map to the lowest hierarcical structure.
		13.	Not all Kanwils or Kantahs have high support from the leaders and management
		14.	Supervision from Kanwils is not optimal due to lack of human resources.
<i>Opportunities (O)</i>		<i>Threats (T)</i>	

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Technological developments for survey and mapping.</li> <li>2. Technology usage in records management (electronic records management).</li> <li>3. Bureaucratic reforms to achieve proportionate number of civil servants and professionals.</li> <li>4. Benefits from out sourcing</li> <li>5. Usage of cloud storage for land base map archiving</li> <li>6. Licensed surveyor policy</li> </ol> | <ol style="list-style-type: none"> <li>1. Good and Clean Governance.</li> <li>2. Bad effect of outsourcing</li> <li>3. High volume of plotting land parcel to land base map</li> <li>4. The complexity of BPN problems.</li> </ol> |
|--|--|

#### 4. FINDINGS

Some of the conclusions derived from the results of the evaluation are as following:

##### 1) Availability of Land Base Map

Based on the inventory in order to figure out the availability:

- a. There are 38 offices (98%) that have land base map given by BPN RI in digital format with varying scale of 1: 10.000, 1:1.000 and 1: 2.500.
- b. There are 24 offices (62%) that have and use base maps from other institution
- c. There are 10 offices (26%) that have land base map in aerial photo/images, 25 offices (64%) that have land base map in aerial photo/images and vector maps, and only 4 offices (10%) that only have land base map in vector format.

##### 2) Effectiveness of Land Base Map Usage

Based on the study relating to usage, we could find the following

- a. 98% offices uses the land base maps given by BPNRI effectively.
- b. From a total of 39 offices, 2 (5%) claimed very dissatisfied, 8 offices (21 %) were not satisfied, 18 offices (46 %) said they were satisfied, and 11 offices (28 %) were very satisfied

##### 3) Constraints and Barriers in increasing the usage for cadastral application

Based on the evaluation, there were several obstacles and barriers in improving the utilization of the land base maps.

###### a. Data

Constraints related to the usage is due to the scale is too small (1:10.000) or low spatial resolution imagery. It makes the identification and interpretation is quite

difficult. Moreover, the scope of data available is relatively small; not yet cover the entire administrative area of the offices.

**b. Human resources**

- 56% of the offices were stating that they have no adequate employees. Approximately 28.7% of the employees in the Survey and Mapping Division are above 50 years old and soon to retire.
- Approximately 56% of the employees only have high school equivalent education and D1. Approximately 41.3% of employees have suitable educational qualifications and approximately 58.7% did not have appropriate background. Number of employees that have functional position is less than 4%.
- Only 50% of the employees in the division have the required competencies and skills required for the position. Competence includes the ability to use devices terrestrial surveying, GPS receivers and data processing, to draw using AutoCAD/GIS software.
- There was a problem about employee rotation and mutation that sometimes too often. It makes the staff could not focus in one steady position and skill.

**c. Infrastructures and facilities**

- Several Kanwils and Kantah still do not have adequate equipment for specific purposes. From 39 offices only 72% have the measuring tape, only 77% have Theodolite T0; Theodolite Electronic Total Station (ETS) is 90%; Handheld GPS is 90%; Geodetic GPS/CORS is 64%; computer for mapping is 95%, and computer storage for spatial database is 82%.
- Kanwils and Kantah were not entirely have the ideal infrastructure to work. From total, 38% still have no working room where every work can be done properly.
- In general, Kanwils and Kantah do not have reliable infrastructure and records management system. From 39 offices, 51% offices have poor infrastructure and facilities. This condition shows that land base map management has not been a priority.

## 5. RECOMMENDATIONS

Based on the results from the assessment and SWOT analysis, we recommended some strategies to enhance the use of land base map at BPNRI:

1. Improve the quality of land base map from scale, resolution, and process. Meaning the produced scale should be in detail scale (1:1.000 or 1:2.500).
2. Extending the coverage of production, not only focuses on big cities but also cover rural areas.
3. Developing and using cloud storage technology as a mirror for distributing the maps so there is no more complain about accessibility
4. Capacity building to upgrade land surveyor expertise and skills by technical training, reward and punishment method, and other relevant actions.
5. Assets (tools and equipment, hardware, software, maps) management



6. Infrastructure development is a must
7. Archive management needs to be established.

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