

## DYNAMICS OF THE CADASTRE SYSTEM: AN ANALYSIS OF CHALLENGES AND EVALUATION OF CADASTRE IMPLEMENTATION IN VARIOUS REGIONS OF INDONESIA

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### Abstract:

**Background:** The implementation of the land cadastre system in Indonesia presents complex social, economic, and political implications. Despite its formal establishment, the system continues to face substantial challenges across various regions. The persistently low levels of land registration in certain areas underscore significant deficiencies in the system's execution, potentially heightening legal ambiguities and intensifying agrarian conflicts.

**Purpose:** This study analyzes the issues of Indonesia's cadastre system and evaluates its implementation across various regions from the perspectives of land valuation, technology utilization, and stakeholder involvement.

**Design/methodology/approach:** This study employs a qualitative approach. A total of 428 respondents, all of whom represent state officials within the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) at various levels, participated in the study. Data analysis was conducted using descriptive analysis by comparing the issues and implementation of the land cadastre system across the Western, Central, and Eastern regions of Indonesia.

**Findings/Result:** The national cadastral system in Indonesia is plagued by five primary issues: overlapping land certificates, outdated and inaccurate land data, incomplete land registration, imprecise boundary mapping, and inconsistent coordinate measurements, which are also prevalent at the local level. These challenges are exacerbated by significant regional disparities, with Eastern Indonesia showing the lowest levels of land registration and technology adoption, in stark contrast to the more developed Western and Central regions.

**Conclusion:** Indonesia's cadastral system faces critical challenges, including legal uncertainties, overlapping land certificates, and outdated data, which are exacerbated by significant regional disparities, particularly in Eastern Indonesia. To address these issues, it is essential to implement targeted reforms that enhance local government capacity, integrate advanced technology, and ensure public participation, thereby improving cadastral accuracy and equity across regions. These efforts are crucial for ensuring legal certainty, reducing agrarian conflicts, and supporting sustainable land development nationwide.

**Originality/value (State of the art):** This study comprehensively maps the issues related to the cadastral system and evaluates the level of cadastral implementation across different regions of Indonesia, categorizing them into Western, Central, and Eastern regions.

**Keywords:** cadastre system, cadastre challenges and issues, regional disparities, cadastral implementation, land valuation

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## INTRODUCTION

The implementation of the cadaster system in Indonesia is an issue with broad implications, encompassing social, economic, and political dimensions. Land, as a fundamental element of human life (Blondel and Aronson, 1999), serves not only as a primary resource for survival but also as a determinant of identity and social relations within communities (Bebbington and Batterbury, 2001). In the Indonesian context, the relationship between people and land, known as agrarian relations, is characterized by complexity and multidimensionality, as stipulated in the Basic Agrarian Law (UUPA) of 1960. This relationship spans from individual identity (micro) to broader social (Bebbington and Batterbury, 2001), economic, and political dynamics (macro) (Hirsch, 2020). Within both national and international systems, land is central to various interests, often leading to conflict (Wohlforth, 2014). Therefore, establishing a well-ordered and regulated agrarian relationship is crucial to ensuring legal certainty and minimizing the potential for conflict (Widarbo and Kusmiarto, 2023; Martono et al. 2021).

One of the primary instruments for regulating agrarian relations is the land registration system, commonly referred to as the cadastre. According to McLaughlin and Nichols (1989), a cadastre is understood as an official record that encompasses information about land parcels, including boundaries, ownership, usage, and the value of the land. Additionally, the cadastre functions as an up-to-date parcel-based land information system that records various interests in land, such as rights, restrictions, and responsibilities (Zevenbergen, 2002). In Indonesia, the cadastre system has been formally regulated since the enactment of the Basic Agrarian Law (UUPA), although the term “cadastre” had been used interchangeably with land registration before the UUPA (Hermanses, 1966). The implementation of the cadastre in Indonesia has undergone significant transformations (Widarbo and Kusmiarto, 2023) through several key periods, including the era of Government Regulation 10/1961 and Government Regulation 24/1997, each of which introduced more systematic mechanisms and programs for land registration.

Despite these efforts, the implementation of the cadastre system in Indonesia continues to face significant challenges. Martono (2022) highlights that

key elements of the cadastre, such as legal and spatial aspects, have not been fully realized in many regions. This study’s findings indicate that while compliance with land boundary delineation is relatively high, the stringent technical requirements, particularly regarding the establishment of permanent boundaries, remain difficult to meet. The primary factors influencing cadastre implementation include the participation of land rights holders in the registration process and the availability of base maps that meet technical standards. These limitations create gaps in cadastre implementation, which can impact legal certainty and increase the potential for agrarian conflicts.

Data from the ATR/BPN application dashboard up to the year 2024 indicates that only a small fraction of provinces in Indonesia have fully registered villages (BPN RI 2024). Figure 1 illustrates the percentage of fully registered villages, revealing that only six provinces East Kalimantan, Yogyakarta, East Java, West Java, Bali, and Aceh have a registration rate above 2%. Upon further analysis, Figure 1 also shows that the percentage of fully registered villages is predominantly concentrated in the Western regions of Indonesia. This stands in stark contrast to the Eastern regions of Indonesia, where none of the provinces among the five assessed have any fully registered villages.

This indicates a significant disparity in the implementation of the cadastre system across different regions of Indonesia. The majority of villages have yet to achieve the desired level of land registration, underscoring the need for comprehensive efforts to enhance the coverage and accuracy of land registration throughout the country.

The low level of land registration has resulted in many parcels lacking clear legal status, thereby impeding legal certainty and the protection of land rights for owners. This situation corroborates the findings of Van der Eng (2016) and Martono et al. (2021), who noted that the land cadastre system in Indonesia remains incomplete. Similar challenges are faced by other countries, as highlighted by Meteshkin et al. (2022) and Tykhenko and Bavrovska (2020). This situation has the potential to slow down development and investment processes due to uncertainties in land ownership, and may lead to numerous agrarian conflicts. Consequently, further research is required to analyze the challenges in the implementation of the cadastre system in Indonesia.

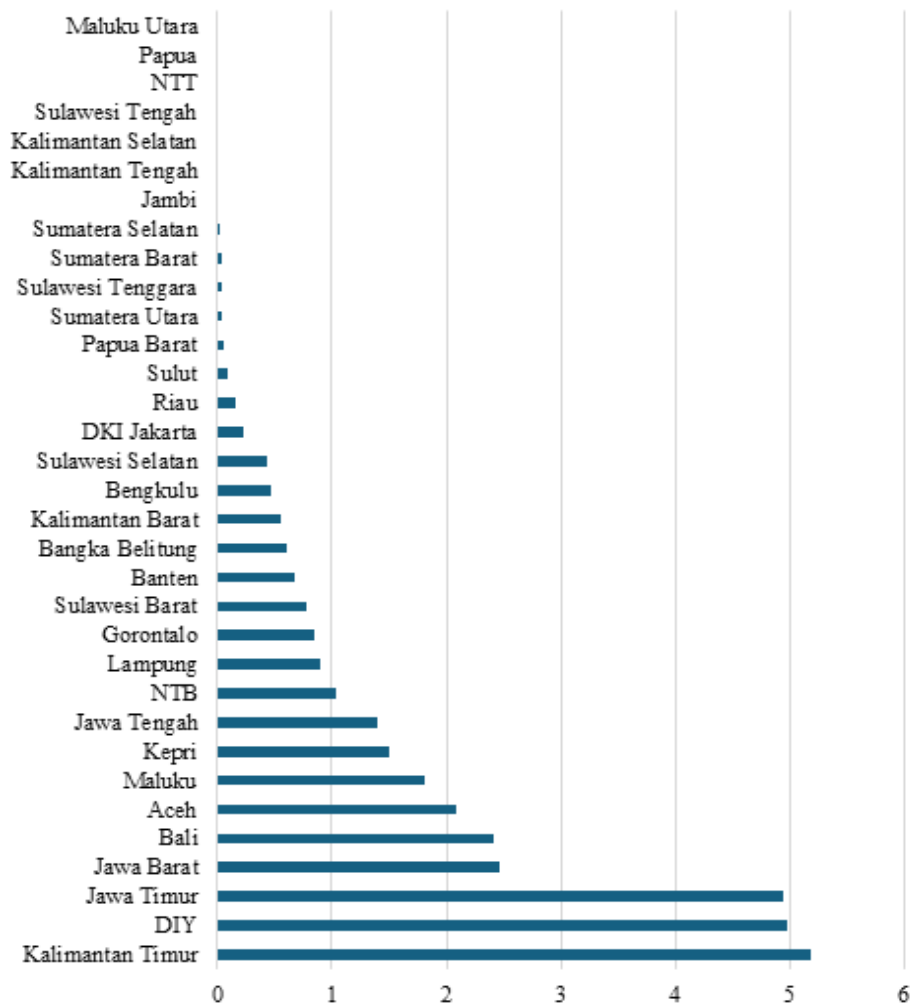


Figure 1. Percentage of registered villages in Indonesia

Research related to cadastre, which serves as a reference for this study, has been conducted by Martono (2022), Williamson (2001), Zevenbergen (2002), and Hermanses (1966). However, these studies have not comprehensively mapped the issues surrounding the cadastre across various provinces in Indonesia. This study addresses this gap by evaluating the level of cadastre implementation in different regions of Indonesia, dividing them into Western, Central, and Eastern regions. This regional division is based on the time zone divisions in Indonesia, which also reflect the general socio-cultural differences across the country. The basis for this regional division refers to Presidential Decree No. 41 of 1987 and Rustiadi et al. (2017). Therefore, the objectives of this research include analyzing the challenges of the cadastre in Indonesia and evaluating the implementation of the cadastre from the perspectives of land valuation, technology utilization, and actor involvement.

## METHODS

This study is a qualitative research employing a purposive sampling approach. Respondents were selected based on their level of authority and responsibility, ranging from national-level officials (Ministers) to Heads of Land Offices at the district/city level within the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). A total of 428 respondents participated in this study, representing government officials from various levels within the ATR/BPN Ministry. Table 1 provides a list of the research respondents.

The division of the three regional sub-samples in this study is based on Presidential Decree No. 41 of 1987, which delineates the three time zones in Indonesia (Western Indonesian Time, Central Indonesian Time, Eastern Indonesian Time). Additionally, this regional division indirectly reflects the geographical and topographical conditions, as well as the levels of development and infrastructure. From the total of

428 respondents, the study further categorizes them into three clusters representing the Western, Central, and Eastern regions of Indonesia. Table 2 presents the regional divisions used in this study and the distribution of respondents across these regions.

The issues related to the cadastre were identified by listing the cadastre problems occurring in each region, including the availability of certificates, data reliability (up-to-date and accurate), registration, mapping accuracy, data measurement consistency, and the use of technology. The evaluation of cadastre implementation was conducted through a survey approach and analyzed descriptively, focusing on aspects such as the success of land registration, the quality of recorded data, the efficiency of administrative processes, and the level of community involvement in the cadastre system. The percentage for each issue and the implementation of the cadastre can be calculated using Equation 1.

$$X_{i-j} = (\sum X_i) / n \times 100\%$$

$X_{i-j}$  = percentage of problems/implementations  $i$  to  $j$

Before conducting the survey with respondents, the questionnaire underwent validity and reliability testing, achieving a corrected item-total correlation value greater than 0.361 ( $\alpha=0.05$ ) and an Alpha value greater than 0.61. The framework for this research can be seen in Figure 2.

Table 1. Research Respondents

Position	Number of Respondents
Minister/Former Minister of ATR/BPN	1
Secretary General of ATR/BPN	1
Inspector General of ATR/BPN	1
Director General of ATR/BPN	7
Director, Head of Bureau, Head of Center, Secretariat of Director General and Inspectorate of ATR/BPN Region	32
Head of Regional Office (Kakanwil) of BPN	33
Regency/City Land Office (Kantah) of BPN	353
Number of respondents	428

Table 2. Regional Division of Indonesia

Region	Province	Number of Respondents by Region
West Indonesia	Sumatra, Java and Madura, West Kalimantan, and Central Kalimantan	251
Central Indonesia	East Kalimantan, South Kalimantan, Bali, NTB, NTT, and Sulawesi	144
East Indonesia	Maluku and Papua	33

The image presents a flowchart illustrating the challenges and necessary steps for improving land registration and cadaster systems in Indonesia. It begins by highlighting the low rate of land registration across various regions, which points to significant shortcomings in the current cadaster system, potentially exacerbating legal ambiguities and agrarian conflicts. To address these issues, the first step involves identifying cadaster problems at both the national and regional levels. Following this, the effectiveness of cadaster implementation at these levels is evaluated. Ultimately, the chart suggests that comprehensive recommendations for land cadaster improvement are essential for sustainable land management in Indonesia.

## RESULTS

### Cadastre Issues in Indonesia

The evaluation of cadastre implementation was conducted by analyzing various aspects of cadastre execution across different regions in Indonesia. Based on the survey of 428 respondents, data revealed that there are seven common issues related to land registration cadastre occurring in various regions of Indonesia (Table 3).

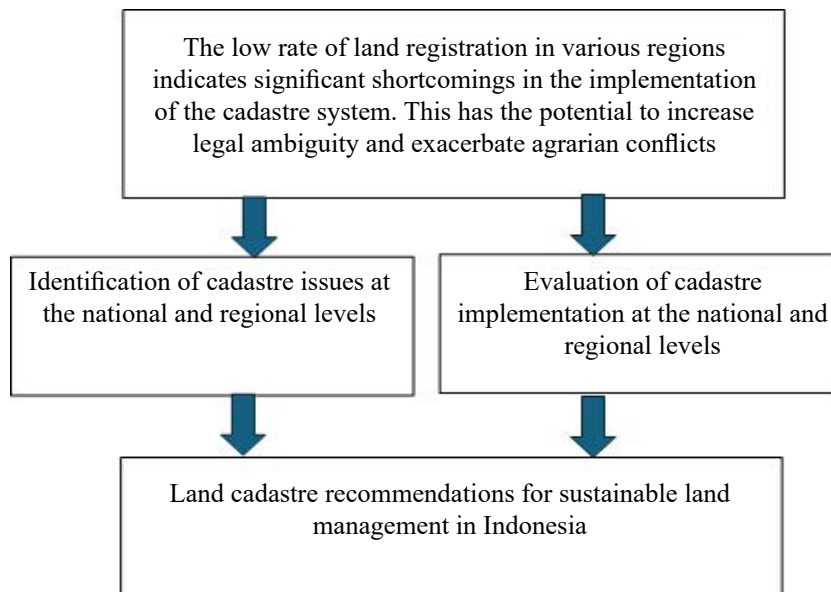


Figure 2. Research framework

Table 3. Issues in land registration cadastre in indonesia

Issues in Land Registration Cadastre in Indonesia	Percentage
The existence of duplicate (overlapping) land certificates	64,0
Land data is not up-to-date and accurate	61,4
Not all land parcels have been registered	49,2
Lack of precision in land parcel mapping	33,4
Inaccurate land coordinate measurements	31,1
Absence of cadastral or registry data	23,6
Insufficient use of accurate and efficient technology	22,5

Based on the survey results presented in Table 3, five key issues have been identified in the land cadastre system in Indonesia: the existence of duplicate (overlapping) certificates, land data that is not up-to-date and accurate, the lack of registration for all land parcels, insufficient precision in land parcel mapping, and inaccurate land coordinate measurements. Williamson et al. (2010) and Zevenbergen et al. (2013) have noted that issues related to the cadastre are often due to problems with data, participation, budgeting, and technology.

These five issues indicate a lack of regulatory clarity and insufficient coordination between relevant institutions (Mardiana et al. 2016). Additionally, ATR/BPN officials have reported that data quality, due to the minimal adoption of technology and the accuracy of maps, remains a significant concern. Inaccurate land coordinate measurements are often attributed to poor data quality and inadequate mapping precision, which can lead to legal uncertainties that disadvantage the public. Similar challenges have been observed in other

countries, such as Ukraine (Tykhenko and Bavrovska, 2020).

When further analyzed based on regional categorization, the primary issues observed in the Western, Central, and Eastern regions show similar trends, with the three dominant issues being duplicate certificates (overlapping), outdated and inaccurate land data, and the lack of registration for all land parcels. This suggests that the existing data management systems, information infrastructure, and available resources are not yet fully adequate to support the effective implementation of a robust cadastre system.

Figure 3 illustrates the cadastre issues occurring across various regions of Indonesia. Two dominant problems that are prevalent in almost all regions are the persistence of duplicate (overlapping) certificates and outdated and inaccurate land data. Data issues emerge as the most significant challenge, with the highest average values across all three regions. In practice, these problems

contribute to overlapping land boundaries, which often result in land disputes due to inaccurate delineation.

Based on Figure 3, the highest average incidence of cadastre issues appears to be in the Western region of Indonesia (53.54%). However, a closer look reveals that the highest average percentage of fully registered villages is also in the Western region (1.28%), with the lowest in the Eastern region (0.37%). The Western region has the highest number of villages (54,804), indicating the complexity of the issues within it. Conversely, the Eastern region, with the lowest number of villages (11,066), has yet to register any village as fully completed. This disparity highlights the unequal access to cadastre services and infrastructure levels, ultimately affecting the success of the cadastre system. The World Bank (2014) reported findings from the Land Governance Assessment Framework (LGAF), which revealed disparities in land access and management. The Western region of Indonesia has better land access and management compared to the Central and Eastern regions. In remote areas of the Central and Eastern regions, access to land registration services is often limited, contributing to legal uncertainty and land conflicts. In Central and Eastern Indonesia, limitations in technological access, such as the use of GIS and modern mapping technology, lead to inaccuracies in cadastre maps and slow land registration processes.

Based on the survey and interview results, the challenges in the land cadastre system within the operational areas of the BPN Regional Office and the District/City Land Offices are clearly evident, ranging from duplicate certificates to the lack of up-to-date and accurate data. Each issue reflects the complex challenges of land management in Indonesia.

Insights from stakeholder interviews further emphasize obstacles such as inadequate basic infrastructure, the complexity of resolving land disputes, and the limited involvement of communities in the mapping process.

From a cadastral perspective, these findings indicate that achieving legal certainty and effective land management requires a comprehensive, integrated, and accurate land cadastre. The cadastre should not only function as a land administration tool but also serve as a foundation for sustainable development and the protection of community land rights. The challenges faced, such as inadequate inter-agency coordination, data inaccuracies, and regulatory complexities, demand ongoing efforts in regulatory simplification, infrastructure improvement, and capacity building.

### Evaluation of Cadastre Implementation in Indonesia

The evaluation of the cadastre system's implementation is crucial for understanding the realities on the ground. Williamson et al. (2010) suggest that assessing cadastre implementation can be approached by examining legal aspects, mapping, administrative efficiency, affordability and accessibility, and sustainability. Zevenbergen et al. (2013) highlight four important aspects: inclusivity, community participation, transparency, and data reliability. McLaughlin and Nichols (1989) emphasize the system's functionality, consistency and standardization, and responsiveness to change. This study combines these evaluation aspects, focusing on standardization, particularly land valuation, community participation as indicated by stakeholder involvement and their roles, and data reliability, approached through the utilization and accuracy of technology.

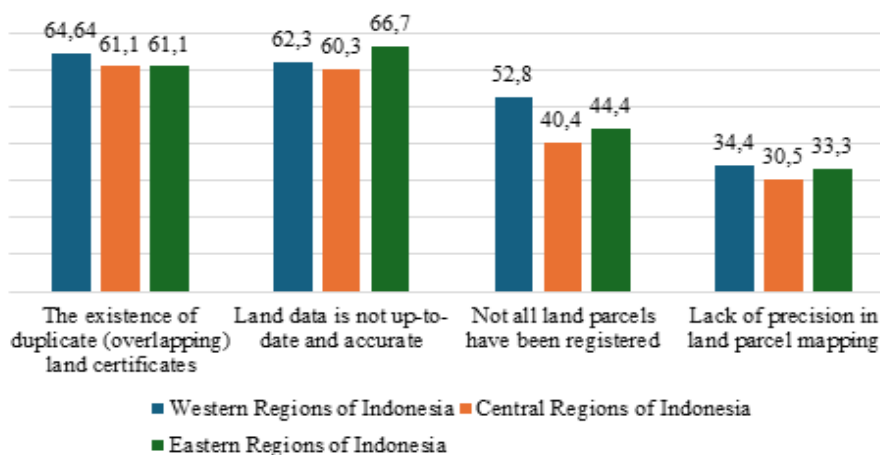


Figure 3. Cadastre Issues in Western, Central, and Eastern Regions of Indonesia

## Land Valuation Methods

In Indonesia, land valuation involving market prices, land use, accessibility, social value, and a combination of these factors is regulated by various laws and technical guidelines issued by the government (Law No. 2 of 2012 on Land Acquisition for Development in the Public Interest Article 33, Regulation of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency No. 4 of 2020 on Land Valuation in Land Acquisition for Development in the Public Interest Article 5, Regulation of the Minister of Finance No. 150/PMK.06/2017 on Guidelines for the Implementation of Property Valuation Article 10). Based on these regulations, this study categorizes land valuation methods into three types: market price-based land valuation, non-price-based land valuation (including land use, accessibility, and social value), and a combination of both methods.

This study identifies a discrepancy between the perceived methods of land valuation and the actual practices implemented in the field (Figure 4). According to respondents, the ideal approach to land valuation should be based on both market and non-market factors. This is reflected in the fact that more than 50% of respondents favored this dual approach. However, the study also reveals that, in practice, land valuation methods are predominantly based on market

prices. This finding underscores the complexity of land valuation approaches across different regions, influenced by the characteristics of the land and local policies.

When further analyzed by region, land valuation practices in Eastern Indonesia tend to utilize both market and non-market approaches concurrently. As shown in Figure 4, the percentage of land valuation practices using both approaches in Eastern Indonesia is significantly higher than in the Western and Central regions. This aligns with observations by the World Bank (2014), which highlighted that land markets in remote and less developed areas are often less active, necessitating the inclusion of non-market approaches in land valuation to provide a more representative assessment. Additionally, USAID (2012), in its report “Indonesia: Land Tenure and Property Rights Portal,” notes that customary land rights and the social value of land are often not reflected in formal market prices, making it essential for land valuation in these regions to incorporate non-market factors. In many areas, particularly in Eastern Indonesia, customary land rights are not always captured in market prices. If land valuation is based solely on market prices, these customary rights may be overlooked, potentially leading to the marginalization of indigenous communities and undermining social relations.

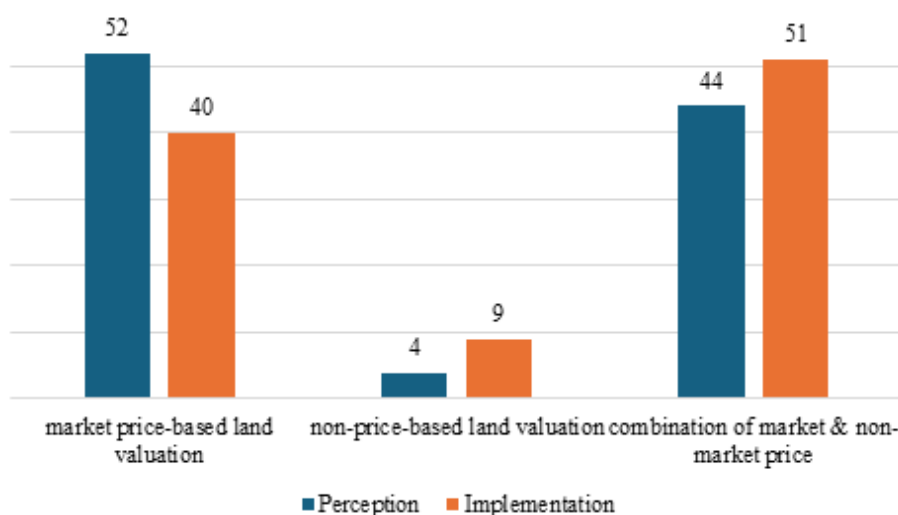


Figure 4. Perceptions and realities of land valuation implementation in Indonesia

An intriguing finding from Figure 5 is that the Western and Central regions of Indonesia are predominantly characterized by market price-based land valuation. This phenomenon aligns with the World Bank's (2009) study, which indicates that in more developed regions, the levels of urbanization and economic growth have driven a more dynamic land market, with market prices serving as the primary indicator in land valuation. The Asian Development Bank (2016) also notes that more advanced infrastructure contributes to higher land and property prices, making market price approaches more dominant in land valuation.

Therefore, the conclusion that can be drawn is the need for continuous efforts to enhance the understanding and application of more comprehensive land valuation methods. This involves education, training, and collaboration among stakeholders in the land sector. Only through a holistic and integrated approach can Indonesia optimize its land management, supporting sustainable and inclusive development. This challenge underscores the importance of having an effective system for land registration and administration to ensure legal certainty, equity, and sustainable development. The cadastre is a vital instrument in facilitating land transactions, supporting sustainable land resource management, and protecting community land rights.

### Land Cadastral Mapping Method

Cadastral mapping methods refer to the techniques and procedures used to measure, document, and map land ownership boundaries, serving as the foundation for land registration and ensuring legal certainty over

property. Zevenbergen (2002) and Williamson et al. (2010) discuss various approaches that can be utilized in cadastral land mapping. These methods include the measurement and recording of the physical and legal boundaries of land, along with additional information such as ownership, land use, and land value.

Based on Figure 6, three primary methods are most commonly employed in cadastral land mapping in Indonesia: satellite observation methods (static/rapid static/stop and go/realtime kinematic), terrestrial methods, and photogrammetric methods. The use of two of these methods satellite observation (static/rapid static/stop and go/realtime kinematic) and photogrammetric methods reflects the adoption of technology in cadastral mapping in Indonesia. The satellite observation method is used to obtain geospatial data with a high level of accuracy. On the other hand, the photogrammetric method, which generates spatial data from the processing of aerial photos or satellite imagery, utilizes advanced mapping technology to acquire accurate and detailed data. However, in practice, the terrestrial method, which involves direct measurement using geodetic instruments in the field without satellite assistance, remains a significant choice in land surveying and mapping.

When further evaluated at the regional level, the conditions regarding the utilization of technology in cadastral mapping across different regions can be understood. Figure 6 illustrates the methods used in cadastral mapping in the Western, Central, and Eastern regions of Indonesia.

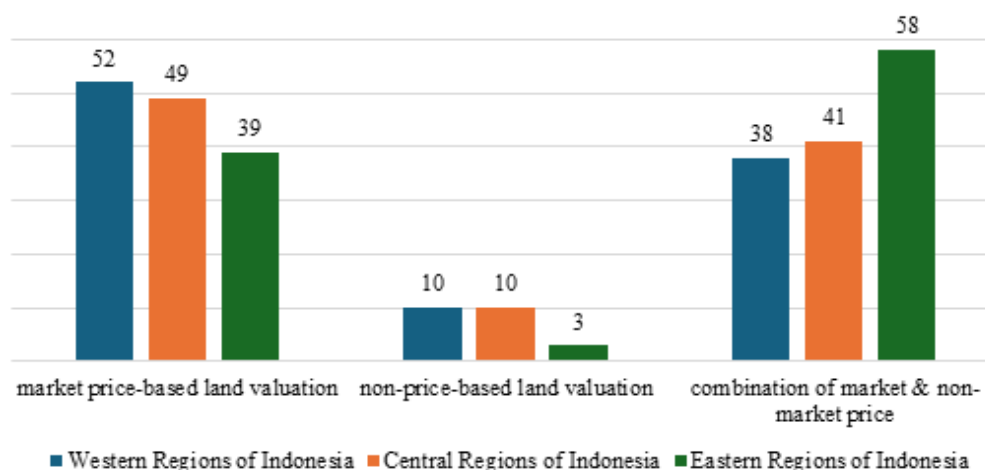


Figure 5. Land valuation methods in western, eastern, and central Indonesia



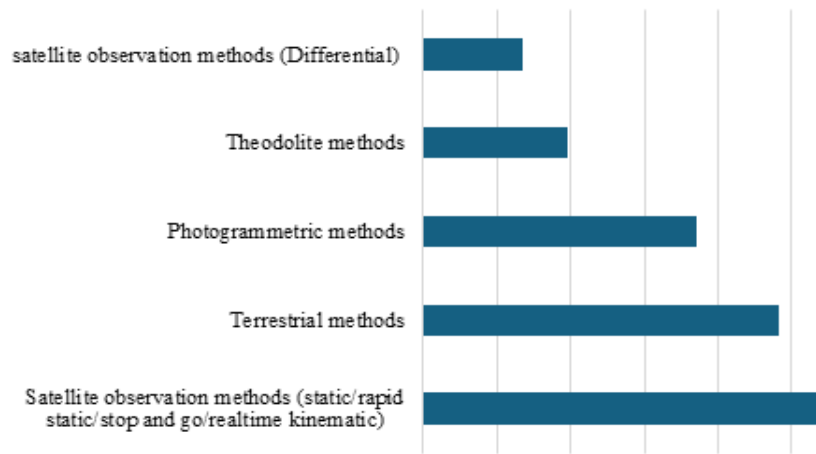


Figure 6. Methods used in cadastral land mapping in Indonesia

Based on Figure 7, it is evident that cadastral mapping in Eastern Indonesia is still predominantly carried out using methods that rely less on technology, specifically terrestrial methods and theodolite-based techniques. In Eastern Indonesia, only a small proportion of the mapping has begun to incorporate satellite observation technology. This stands in contrast to the situation in Western and Central Indonesia, where high-tech methods such as photogrammetry and satellite observation are more widely utilized, often in combination with terrestrial methods. From a cadastral perspective, selecting the appropriate method is crucial for effective land management. Each method has its advantages and disadvantages that need to be carefully considered in terms of accuracy, efficiency, and cost.

### Stakeholders Involved in Cadastral Land Mapping

The involvement of stakeholders in cadastral land mapping is a crucial element to ensure that the mapping and land registration processes are conducted transparently, fairly, and sustainably (Williamson et al. 2010, Zevenbergen, 2002; Dale and McLaughlin, 1999). This principle requires the active participation of all relevant stakeholders. The research findings indicate that many actors are involved in cadastral land mapping in Indonesia, as presented in Table 4

Based on Table 4, an intriguing phenomenon emerges. In all three regions, the roles of the National Land Agency (BPN) and landowners in cadastral land mapping in Indonesia are notably dominant. The role of BPN is crucial in ensuring the accuracy and legality of land data, as well as in the effective administration of the land registration system. The involvement of landowners reflects direct participation by those with a

vested interest in the property. Landowner participation can assist in data verification, boundary delineation, and updating ownership information.

In the Western and Central regions of Indonesia, in addition to BPN and landowners, the roles of village governments and district/city governments are also involved. Village governments play a significant role, particularly in collecting and providing information related to land ownership at the local level. Their involvement allows for the integration of data between national and local levels and strengthens cooperation among the relevant parties. District/city governments are involved in coordinating and managing land data at the regional level, as well as in policy formulation related to land use, urban planning, and infrastructure development.

A different situation is observed in Eastern Indonesia. In this region, the involvement of district/city governments in cadastral mapping is often limited or even absent. Many district/city governments in Eastern Indonesia face resource constraints, including budget, expertise, and technology, which hinder their ability to effectively participate in the cadastral mapping process that requires high technical proficiency. The lack of training and capacity to manage modern mapping technologies further contributes to the low involvement of local governments. Eastern Indonesia is known for its challenging geographical conditions and limited accessibility. The difficult terrain makes the mapping process more complex and costly. In this context, district/city governments, which may already be resource-constrained, find it challenging to directly engage in a mapping process that requires extensive mobilization.

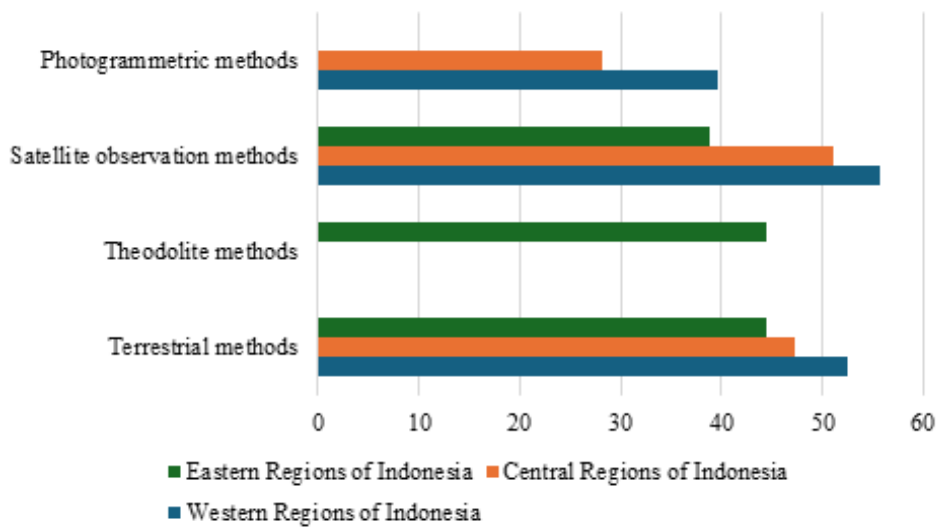


Figure 7. Methods used in cadastral mapping in western, central, and eastern Indonesia

Table 4. Stakeholder involvement in cadastral land mapping in Indonesia

Actors	National Level (%)	Western Regions of Indonesia (%)	Central Regions of Indonesia (%)	Eastern Regions of Indonesia (%)
BPN (National Land Agency)	75.6	77.4	68.7	66.7
Landowners	64.5	63.7	65.6	72.2
Village Government	53.1	53.3	53.5	33.3
District/City Government	27.3	29.7	25.2	-
Community Leaders	26.4	-	-	55.6
Provincial Government	14.8	-	-	-
Police	11.0	-	-	-
TNI (Indonesian National Armed Forces)	10.1	-	-	-

In contrast to Western and Central Indonesia, the involvement of community leaders is prominent in Eastern Indonesia. Community leaders play a crucial role in the cadastral mapping process in Eastern Indonesia, particularly due to the strong presence of customary land rights and the social complexities in the region. Community leaders often possess extensive knowledge of their area and can assist in identifying issues and educating the community about the importance of land registration. They are often regarded as custodians of customary land rights and have the authority to approve or reject mapping activities conducted by external parties (Colchester and Chao, 2013). They ensure that cadastral mapping does not infringe upon or harm the long-recognized and respected rights of indigenous communities in their areas (Arnold and Auger, 2011).

The involvement of various stakeholders in the mapping process reflects the complexity and importance of cross-sector collaboration and active participation from multiple stakeholders in land data

management. This collaboration is deemed essential by the Directorate General of Land and Spatial Surveying and Mapping, which emphasizes that cadastral land mapping requires cooperation with the National Land Agency (BPN), local governments, communities, and even private entities involved in property development. From a cadastral perspective, participation and cross-sector cooperation are key aspects of effective land management.

### Managerial Implications

Based on the findings above, managerial implications have been formulated as strategic steps to improve the cadastral land system in Indonesia, tailored to the local context of each region. First, enhancing the quality and quantity of trained and certified surveying personnel is a top priority, ensuring that every measurement process is conducted with the highest standards of professionalism. Second, the adoption of advanced technologies such as GPS, GIS, and digital mapping systems is crucial

for improving the accuracy of cadastral data. These technologies not only provide more detailed data but also simplify the mapping process, reducing time and costs, and increasing overall productivity. Third, improving the quality of land services provided by the National Land Agency (BPN) is also a focus, with an emphasis on efficiency, responsiveness, and transparency in the land registration process and other related services. Finally, involving the community and village officials in the cadastral improvement process is vital, as this collaboration is expected to encourage active community participation in land mapping and foster closer cooperation between the government and the public to achieve sustainable land management.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusions

Based on the findings of this study, the implementation of the cadastral land system in Indonesia faces significant challenges across various regions, particularly concerning legal uncertainty, overlapping land certificates, and the accuracy of cadastral data. The survey results indicate that the primary issues include overlapping certificates, outdated and inaccurate land data, and the lack of registration for all land parcels. These issues highlight the complexities in land administration management and coordination, especially related to the adoption of technology and the accuracy of land surveys. The findings underscore the importance of improving data quality, public participation, budget constraints, and technology adoption to enhance the cadastral system.

Furthermore, the regional analysis reveals that these challenges are more pronounced in Eastern Indonesia, where access to cadastral services and infrastructure is significantly limited compared to the Western and Central regions. The disparity in the completeness of land registration across these regions emphasizes the need for more targeted efforts to improve cadastral implementation in less developed areas. This includes enhancing the capacity of local governments, increasing public participation, and integrating advanced technologies for more accurate and comprehensive land management. Such measures are essential to ensuring legal certainty, reducing the risk of agrarian conflicts, and supporting sustainable land development nationwide.

### Recommendations

The ATR/BPN must urgently enhance the adoption of technology and strengthen the capacity of local governments, tailored to the fundamental characteristics of each region, to address issues of overlapping land certificates and ensure the accuracy of cadastral data. These measures are crucial for reinforcing legal certainty, reducing the risk of agrarian conflicts, and supporting sustainable land development across Indonesia. Future research could explore how the implementation of cadastral systems is linked to land value capture, aiming to maximize the potential of land as an economic resource, ensure a more equitable distribution of benefits, and support inclusive and sustainable development.

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