



Land Governance in an Interconnected World

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY
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FINDING COMMON GROUND Accelerating Land Registration in Indonesia

**CHRISTELLE VAN DEN BERG (1), HANHAN LUKMAN SYAHID (2), SUZANNE
VALKMAN (1), PAUL SAERS (1)**
(1) Kadaster, The Netherlands; (2) ATR/BPN; Indonesia
Christelle.vandenberg@kadaster.nl

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Abstract

Indonesia's president has initiated measures to enhance land administration capacity in Indonesia. An important ambition in this context is the initial registration of an estimated 85 million individual parcels in a systematic manner by the year 2025. This paper explores the present status of land registration in Indonesia: the legal framework, the actors and their mandates, and the available institutional capacities. One of our conclusions is that the productivity of private sector and government sector surveyor capacity must be substantially improved to attain the objective set for 2025. ATR/BPN, who is mandated to register and administer the individual parcels of Indonesia has risen to this challenge and has embarked upon an ambitious scheme to expand capacity, optimize product quality and forge partnerships for process acceleration. This document describes the current challenges and provides an outlook on the potential for acceleration that finding common ground with land registration partners can bring.

Key Words:

Indonesia, Land Registration, Participative, Partnerships



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1 Introduction

With the National Agrarian Reform Program the President of Indonesia, Mr Joko Widodo, expresses his ambition to accelerate land certification in Indonesia to complete agrarian reform and to address land ownership problems. The Ministry of Agrarian and Spatial Planning/ National Agrarian Agency (ATR/BPN) has set a target that every plot of land in Indonesia has been certified and is registered by 2025.

ATR/BPN's ambition to register all individual parcels of Indonesia by 2025 seems huge, given their budget and staffing constraints. In November 2016 ATR/BPN and Kadaster International signed a Cooperation Agreement. The aim of this agreement is for Kadaster International to support ATR/BPN in the search for new methods to accelerate and improve their land registration processes.

"Hopefully, by 2025, every plot of land in Indonesia will be certified and registered,"

Quote from ATR/BPN Minister Mr Sofyan Djalil Denpasar, Bali, on Aug 5, 2017.

In the first place it was assumed that participatory captured land use data by NGO's, like AMAN and JKPP, was useful to generate the acceleration. Closer analysis of this data shows that the maps are elementary to show spatial conflicts in (mainly) forest areas, in particular between concession holders and forest communities. However the data was not readily applicable for the purpose to accelerate countrywide parcel registration.

In addition we started to review current parcel registration processes in Indonesia and we assessed the feasibility of ATR/BPN's current response to the ambition to map and certify all parcels in Indonesia by 2025. This first research has mainly focused on the time and cost aspects of capturing essential land data, in relationship with the required quality standards. Special attention was given to the costs of identification of parcels and the capturing of spatial attributes. Until now, our research has shown that ATR/BPN already has adopted very innovative approaches in terms of computerization and data capturing methods. We also developed a better understanding of the huge tasks ahead, and the passion and drive of all workers in land administration both inside and outside the official government domain. These conditions have opened a window of opportunity for accelerating land registration by bringing 'bottom up' and 'top down' approaches together.



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The results of this first research and recommendations for follow-up are presented in this report. This is in direct support of ATR/BPN's land administration mandate as an integral part of a holistic approach to land registration in Indonesia. Annex 1 presents some terms and definitions useful for understanding this research.



2 Scope and methodology

2.1 Scope

Currently, Ministry of Environment and Forestry (MoEF) is responsible for the administration and management of 70% of Indonesian forest land area (around 1.3 million km²). This does not mean that this is necessarily forested land. ATR/BPN is responsible for administration of individual parcels on the other 30% of Indonesian land area (almost 0.6 million km²). In this assessment we focus mainly on the area under responsibility of ATR/BPN. Furthermore we focus on first time registration and mapping. Maintenance of land registration systems is not included in our assessment.

2.2 Methodology

This report is based on data that was collected during a field visit to Ujong Jaya and from several interviews with the Ministry of Agricultural and Spatial Planning/National Land Agency (ATR/BPN), the civil society entities JKPP and AMAN and the Millennium Challenge Account (MCA) (see annex 2). These took place between August 2016 and February 2017. For this analysis, we have used well-known and widely accepted Land Administration concepts and standards. Amongst these are the concept of Fit-For-Purpose land administration and the International Standard for land administration data modelling, the Land Administration Domain Model (LADM, ISO 19152:2012).



3 Parcel registration in Indonesia

In this chapter we zoom in on two processes at ATR/BPN to create a full territorial coverage with cadastral maps: the regularisation of documented parcels and first time registration of undocumented parcels. In annex 3: 'Background information' we provide some general statistics especially relevant to land administration such as demographic and administrative data. Subsequently in annex 4: 'Legal framework' we present the general legal framework (including the types of land data ATR/BPN has the mandate to administer) and the institutional framework that support land administration and land management mandates in Indonesia.

3.1 Parcel regularisation and first time registration

Most of Indonesia's documented parcels are in the form of a Surat Ukur, a survey document containing information on a specific surveyed cadastral object, described in text and locally surveyed geometry. These documents have current legal consequences and are therefore relevant to the land administration mandate of ATR/BPN. These documents and the people-to-land relationships that they describe must eventually be included in ATR/BPN's Cadastral Map and Registers as the basis for provision of authentic and reliable Land Information in the ATR/BPN mandate area.

Land regularisation processes aim at reconciling data in legacy land registers and cadastral maps with the actual land rights and land use in a specific administrative area. This includes collecting, retrieving and validating formal land documents, taking statements, surveying and mapping of actual usage, validating claims and identifying and resolving conflicts.

Regularisation is a labour-intensive process that requires legal, technical, social, cultural qualities of the staff involved. The reconciliation process distinguishes several phases: documented parcels, delineated parcels, surveyed parcels, registered parcels and validated parcels. In annex 5 the different phases of the parcel regularisation process are described in more detail. Formal land documents should include all documents relevant to a land registration framework, which means documents recognized by law, but also ancestral domains or even taxation forms and invoices of utility services. Parcels in the process of regularisation are popularly known as 'flying' parcels to indicate they have not 'landed' yet in the formal Land Information System. Beside these parcels that need to be regularised, parcels exist in Indonesia without any form of evidence. These so called 'undocumented individual parcels' need first time registration.



Land ownership evidence types:

- Land tax receipt issued before the year of 1961 such as Patok D/Letter C/ Girik/ Ketitir
- Certificate informing customary legal right over the land such Eigendom
- Property tax receipt (SPPT PBB)
- Land deeds issued by notaries (Akta Jual Beli Tanah)
- Receipt of land purchase transaction (kuitansi jual beli tanah)
- Certificate informing land ownership issued by village chiefs (Surat Keterangan Tanah)
- Land testament letter (surat wasiat warisan)
- Land charitable certificate (surat ikrar wakaf)
- Land auction certificate (risalah lelang)

3.2 Workload and budget

As mentioned before, it is the ambition of ATR/BPN to have all individual land parcels in Indonesia registered by the year 2025. They estimate that currently around 126 million individual parcels exist in Indonesia. Of these, 50 million parcels are documented and registered through sporadic regularisation process . 25 Million parcels out of 50 million are mapped in a local coordinate system and need to geographically mapped in a national coordinate system and need to be incorporated into ATR/BPN's land computerization system . Of these 50 million, only 1 million have been fully registered as certified parcels in a centralized registration system. The remaining 76 million individual undocumented parcels need first time registration and certification. They will be registered under a systematic individual land registration program.

Currently budget for only 50% of calculated cost for registering 5 million parcels (the planned workload for 2017) is available to ATR/BPN. Other budget sources, like Local Government Budget, Village Funds or Public Private Partnerships are not used yet. The response of ATR/BPN to this huge task is acceleration by enhancing capacity, closely matching data quality with the identified purposes and forging partnerships for highly participative registration methods.



4 Fit-for-Purpose Cadastre in Indonesia

Facing the huge task, ATR/BPN has adopted the concept of Fit-for-Purpose land administration with a multipath approach to accelerating, improving and making the land registration process more economical to the government and more affordable to individual citizens.

The first path embodies the enhancement of both internal and private sector surveying capacity. By the end of 2018 a total capacity of 8.896 surveyors is available: 1.349 licensed surveyors (bachelor level) and 4.492 assistant licensed surveyors (senior high school and 2 years experience) BPN's own capacity is around 3.055 surveyors.

The number of surveyors is still increasing, and according to the plan, in 2018 ATR/BPN plans to recruit more land surveyor in total up to an amount of 10.000 by 2020.

The second path is about diversification of survey and mapping qualities to suit specific land administration goals. Two mapping qualities were defined to suit these specific goals. One quality to support land policymaking and basic security of tenure, the other to support the traditional land administration purposes: provision of tenure security, enabling taxation and valuation and facilitating spatial planning. These are referred to as PIBT ("Peta Informasi Bidang Tanah" as indicative) and PBT ("Peta Bidang Tanah" as certification ready) registrations. Refer to annex 6: 'PIBT and PBT quality requirements' for a more detailed description of the PIBT and PBT quality levels.

The third path is to explore the potential of participative approaches for accelerating land registration. For this approach ATR/BPN seeks to make optimal use of the common cadastral knowledge that exists amongst the communities of (mostly) rural Indonesia. For this purpose, Kadaster has explored the activities of such civil society organizations as JKPP and AMAN who concentrate on delimitation (meaning identification and survey) of ancestral land. This requires effective sensitization of the community as well as effective survey practices.

These delimitations serve the purpose of creating an inventory of land use types and their boundaries, based on appropriate historical and socio-cultural research. These delimitations serve to literally put the communities on the map as socially, culturally and economically relevant entities. Although the outputs of these delimitations are not directly suitable for incorporation into the national level land registrations,



the information they provide is relevant to the One Map harmonisation process and to the various holders of land administration mandates.

The unsuitability for incorporation of the delimitation data is on one hand based on the use of internal standards for data formats, and on the other hand the positional accuracy of the spatial attributes to the data is considered unsuitable for land registration purposes. This means deformations may show in the form of discontinuities, underlaps and overlaps when delimited and georeferenced boundaries will be related to other objects already presented in the national grid.

4.1 Feasibility in terms of time, money and quality

To compare the cost and productivity of both the PIBT and PBTland data capturing methods we have calculated the cost of initial registration of 65 million previously undocumented parcels. Two main cost components are distinguished:

- Surveying costs (base mapping and determining the parcel geometries);
- Non-surveying costs, including:
 - Boundary identification;
 - Acknowledgement / neighbour consensus;
 - Formal certification (collecting legal documents, publication, Issuing and delivering the certificate).

First, we established the cost for making a base map of parcels and to manage the geometry of the parcel. The costs depend very much on the method and tooling selected for determining the parcel geometries. More accurate methods can be considered for PBT type parcels, less accurate methods can be considered for PIBT type parcels. Of course, each method requires specific cost for map material, tooling and surveyor hours.

Annex 7a: 'Parcel geometry capturing costs' shows the surveying costs. The various methods and associated cost and data quality levels in terms of accuracy and resolution (level of detail). These cost extremes define the bandwidth of cost for the various types of parcel registration quality: PIBT quality with indicative parcels, PBT quality for certification-ready parcels and certified PBT quality parcels.

Annex 7b: 'Additional non-surveying costs' shows the non-surveying cost that are calculated and added per parcel type. These costs are based on experience and global estimations.



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In table 1 the cost per parcel type is calculated using various cost components including the base mapping cost. As one can see, we consider the non-surveying costs to be comparable for both types of PBT and PIBT maps. Depending on the cost for surveying, costs vary between 7 and 16 dollars for PIBT parcels and between 18 and 27 dollars for registered PBT parcels.

cost per parcel		min \$	max \$	time in minutes
PIBT parcels	Basemapping	0,03	1,06	0,00
	Geometry Management	0,48	0,48	4,80
	Participative Boundary Identification	4,44	4,44	22,80
	Participative Acknowledgement	1,68	1,68	16,80
	Totals PIBT type parcels	6,63	7,66	44,40
PBT parcels	Basemapping	0,13	9,00	0,00
	Geometry Management	0,48	0,48	4,80
	Participative Boundary Identification	4,44	4,44	22,80
	Participative Acknowledgement	1,68	1,68	16,80
	Totals PBT type parcels	6,73	15,60	44,40
Certified Parcels	Basemapping	0,13	9,00	0,00
	Geometry Management	0,48	0,48	4,80
	Participative Boundary Identification	4,44	4,44	22,80
	Participative Acknowledgement	1,68	1,68	16,80
	Formal Certification	11,00	11,00	110,00
	Totals Certified Parcels	17,73	26,60	154,40

Table 1: The estimated registration cost components (in \$ and surveyor minutes) per parcel type

As can be seen in table 1, certification adds 200 to 300 percent to the cost of first registration. Also, choosing the proper parcel geometry capturing method has the potential to cut survey cost by 50 percent. It can also be seen that surveying accounts for only part of the parcel registration cost (varying from 15 to 60 percent). It is interesting to compare the affordability of registration in terms of % of monthly per capita GDP. If a methodology implies unaffordable cost levels, it is impossible to attain another key feature of FFP land administration: inclusive land administration. Per capita GDP in Indonesia was 3600 \$ in 2016. A certified parcel registration would cost around 14 % of a one month average income. The average Dutch citizen would pay 10 % (or 440 \$) of his average one month income for a parcel registration. The parcel registration costs thus are comparably affordable in both countries.



5 Conclusions

Our calculations show that, given the estimated workload (65 million individual parcels), available survey capacity (around 5.000 at present, rising to 10.000 by 2020), methodology (traditional survey methods), the current legal framework and the highly compartmentalized nature of land administration mandates in Indonesia, productivity per surveyor currently stands at 2 parcels (through sporadic regularization process) per surveyor per day. If productivity can be made to rise to 10 parcels per day per surveyor the target of full territorial coverage could be met by 2025. Associated cost, using technically advanced, participative methods would be between 0.5 and 1.7 billion US\$ (see table 2) depending on survey quality and actual completion of certification. This matches earlier estimations of ATR/BPN quite well. We think time and cost can be brought down significantly by applying alternative approaches to the registration process in line with the Fit For Purpose guidelines and in compliance with the existing regulatory framework of Indonesia.

# parcels to be registered	Qualities of data	minimum reg cost \$ (millions)	maximum reg cost \$ (millions)	surveyor capacity manyears	suitable purposes
65.000.000	PIBT Quality Parcels (indicative quality)	431	498	36.075	policy development, spatial planning
	PBT Quality Parcels (certification quality)	437	1.014	36.075	as above + taxation, valuation, plannin
	Certified Quality PIBT parcels	1.152	1.729	125.450	as above + ultimate legal certainty

Table 2: The total estimated costs for registering 65 million parcels per registration type

In addition to ATR/BPN's excellent response to the huge ambition by distinguishing different parcel qualities, alternative options to accelerate land registration should be investigated. The time, cost and capacity requirements associated with traditional surveying force us to explore new land data capturing, validating, certification and publications methods. Capturing processes must be designed to work as participative and parallel as possible to reduce workloads, timeframes and costs, while spatial and administrative detail levels must be closely aligned with the associated land administration purpose. If necessary, the legal framework should be adapted to accommodate new spatial and administrative detail levels.



6 Considerations

There is potential for accelerating and lowering the cost of land registration in Indonesia using FFP land administration approaches. FFP advocates the priority of completeness over detail and precision of land administration data, allowing for incremental improvements of these aspects at later stages. This allows data capturing, time and cost aspects to be optimised against acceptable data quality; the so-called minimal viable product.

The FFP approach should be combined with the international LADM standard. LADM promotes standardisation of land administration data structures, allowing land data sets to be easily harmonised at later stages. One should concentrate first on unique identification of parcels and less on the spatial qualities of the associated parcel boundary. A definitive parcel identifier combines well with indicative boundaries and with an indicative surface area of the land. Such indicative data provides adequate information for most land administration processes such as provision of tenure security, taxation, valuation and land use planning. This is based on the FFP principle that land administration should be regarded as an administrative rather than as a legal process.

The essence of FFP Land Administration lies in the application of participative methods and modern technology. To accommodate this approach, the appropriate spatial, legal and institutional frameworks needs to be provided. The current One Map policy implementation effort is an important facilitator for building these accommodative frameworks. One Map developments provide important context to this assessment. The operationalisation of the One Map policy is currently being planned by the Government of Indonesia. A World Bank Grant has been obtained for this purpose. The objective of the policy is to provide an authentic, unambiguous, complete, accurate, integral and reliable source for land administration data for the government and citizens of Indonesia. This requires the identification, verification and publication of all land rights in Indonesia. This will be a huge task, requiring government and population-wide identification and validation of all relevant documents and other sources of evidence.

In practice, administrative and spatial data can be captured by the parties to the land rights themselves, for example by using government-provided apps and if required specialist tooling. The app would allow people to make spatial observations, if necessary repeatedly, record subject, object and documentary evidence pictures. The process can be supported, monitored and reported upon almost real-time. Land



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professionals would only support or intervene as far as the interests or purpose involved requires this. Local people would be educated to provide trusted support, information, advice and advocacy and later have a role in signalling mutations that are essential triggers for the maintenance process. Such approaches are currently being tested in South American, African and Asian countries. The goal is to provide land administration services at an average of less than 15 US\$ per parcel certificate, while providing entrance level services at 1 US\$ (proto cadastre parcel recording).

As mentioned before our calculations show that, given the currently available institutional capacity (staff, processes and budgets), ATR/BPN's ambitions for 2025 cannot be met. We should therefore also explore how land registration capacities that exist outside the government domain can be mobilised to realise ATR/BPN's ambitions. Important Land Registration capacities exist amongst NGO's and the general public. Therefore, we have engaged with local communities and other civil society entities such as JKPP and AMAN who capture land use data amongst Adat (customary) communities as well as the Millennium Challenge Account (MCA Indonesia) Project aimed at supporting administrative boundary identification.

JKPP and AMAN educate and mobilise public knowledge about people-to-land relationships. They capture and register data on these relationships using modern and affordable tools such as UAV's and simple GPS devices. Their results show the huge potential of participative land registration. On the downside, there is not enough data standardisation and the levels of quality control are unclear. Compliance with land data standards and adequate quality control are essential for acceptance of these data into national level land information systems. If we want to tap into this huge potential of participative data collection, for the sake of speeding up and reducing the cost of land registration, we must find a way to manage these issues. Applying FFP land administration approaches and LADM standards makes this perfectly possible.



7 Recommendations

As mentioned before the unsuitability for incorporation of the delimitation data from NGO's is on one hand based on non-compliance with the (later defined) data format. On the other hand it is considered non-compliant for lack of positional accuracy of the spatial attributes to the data. This means deformations may show when delimited and georeferenced boundaries will be related to other objects already in the national grid. We believe that these deficiencies can be resolved effectively by applying the desired format and involving survey experts in specific phases in the registration process. In this way, the expertise of civil society actors in sensitising rural communities to involve themselves in land registration can be used to unlock the cadastral intelligence that exists amongst members of (traditional) communities.

In two pilot areas in Indonesia collaborative mapping will be elaborated through a combination of top-down and bottom up approaches, involving multi actors and varied standardized methods, aiming at efficient and good quality outcome. ATR/BPN has identified the laws required for land administration through community participation by using aerial photographs and high-resolution satellite imagery to accelerate land registration see annex 8: 'Legal framework'

Kadaster, together with ATR/BPN, Civil Society actors, Academia and Private Sector Process Innovators will jointly research alternative approaches to involve local communities and civil society actors in land registration as a useful alternative to traditional 'top-down' approaches. The strategy will be that full coverage of the land administration system takes precedence over sporadic in-depth surveys and registrations. This way the land administration content that is created will facilitate adequate land policymaking for instance policies required for implementing the Sustainable Development Goals (SDG's) adopted by all members of the UN. The quality of the survey and registration may be improved where and when it will be required and effective to attain set objectives.

Good land registration practices require careful registration of what parties involved agree on in terms of boundary and rights identification. It also requires provision of effective dispute resolving capacity. We expect that with improved and effective information and sensitisation, in combination with community-level ownership of the process, will significantly reduce the registration time and cost while ensuring high agreement and low dispute levels.



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Additionally, the process of identification of parcels and their boundaries will be organised in such a way that maximum use is made of modern, collaborative and participatory approaches. Here we will select appropriate methodologies that suit the specific local terrain conditions (weather, vegetation, soil) the available technical infrastructure (monumentation, reference stations, instruments, processing capacity) and the socio-cultural context (governance, traditions, attitudes, education levels). To validate these expectations for accelerated and reduced cost land registration, two pilot areas will be selected with various community attitudes towards land registration.

The design of the pilot aims at presenting a showcase to support and enhance the quality of political decision making for a multi-partner, participative approach. To ensure the scientific and professional qualities of the showcase, academia will be involved in the process design, the monitoring and reporting. Local land registration committees will essentially own and implement the registration process, closely monitored and advised by the associated Regional ATR/BPN Offices. Local private sector surveying capacity will join in to ensure positional accuracy where it matters most. Indonesia's BIG (the centre for geographical information dissemination) will monitor positional accuracy of the parcel geometry. The civil society actors involved will deploy their excellent community mobilisation and aerial surveying capacity.

One challenging task to be solved is to transform government-facilitated and community-facilitated participatory mapping for land registration into an accepted product for land registration, combining visual boundaries and field marking for producing a set of agreed land boundaries.



Annex 1: Terms and definitions

This annex presents some terms and definitions useful for understanding this research. The term ‘land rights’ as used in this document includes all relationships between people and land. This includes legal, legitimate or factual relationships. Land management is defined as the practices to use and develop land resources. Land governance is defined as the control and management of physical space as the basis for distribution of power, wealth opportunities and human well-being. Usually the term land registration is reserved for the administrative part of a Land Information System.

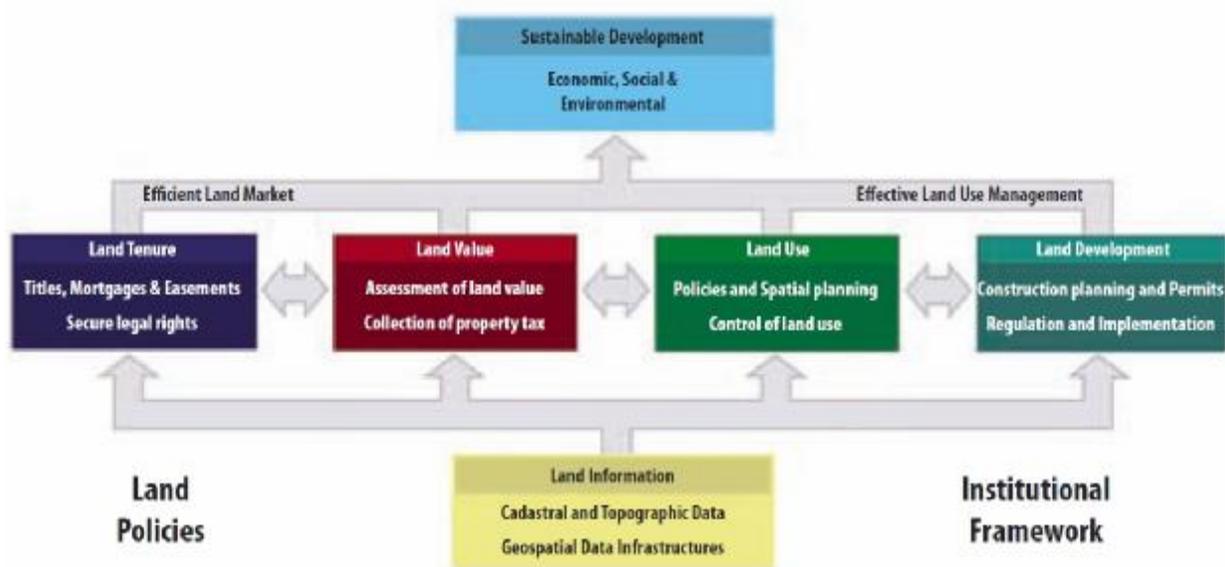


Figure 1: A global land administration perspective. Source: Enemark et al. (2004)

Figure 1 presents the traditional land administration processes: providing security of tenure, land valuation, land use planning and land development. Ultimately these land administration processes support and drive the sustainable economic social and environmental development of Indonesia.

Land registration and cadastre are used for the process of collecting, processing of land data for dissemination of information of people to land relationships in the form of land information. This land information is used as an informational basis for land administration processes, meaning public sector activities to support security of land tenure, land use planning, land valuation and taxation. Land information may also be provided to- and used by non-public sector actors such as the utilities, security, industry and logistics for their own purposes; this is generally referred to as Multi-Purpose Cadastre.



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The terms 'land registration' and 'cadastre' are traditionally used for respectively the administrative and spatial components of land administration. This distinction is rooted in the mandates of individual departments: the land registration office and the cadastre office. In this document, we will use the term 'land registration' for the process of collecting, processing and presenting both administrative and spatial data in an integrated way. We consider this distinction as having become irrelevant and even a bottleneck to modern land information management.

The word 'land recordation' is often used by land professionals to indicate land registration by non-governmental entities thus having no legal consequences, only administrative value. So, mandated government entities 'register' land and non-government entities 'record' land. The distinction is considered important to prevent misunderstandings especially on the part of professionals with a more legalist approach to land administration. But facts only have legal consequences in the context of relevant legal arrangements (from codified, customary or jurisprudence sources). So, this distinction is not so relevant. The better term would be land 'recording', as the word 'recordation' does not exist in authoritative sources on the English language.



Annex 2: Mapping activities by civil society groups

Several civil society groups (extra-governmental players) are active in the field of mapping: AMAN and JKPP who focus on mapping ancestral domains and MCA who focuses on identifying and mapping village boundaries. Their activities are carried out mainly in the area under the mandate of the Ministry of Environment and Forestry (MoEF). This chapter provides an overview of land registration activities carried-out by non-governmental entities.

BRWA

The Ancestral Domain Registration Agency (BRWA) is set up by several NGOs to consolidate the indigenous community's maps into one registry system and database. BRWA regularly submits the community maps to different ministries. <http://www.brwa.or.id/>

JKPP

The Indonesian Community Mapping Network (JKPP) is a network organisation which was founded in 1996. It has more than 100 members (NGO's) and aims to accelerate mapping and recognition of customary land by the government.



Until now JKPP has mapped around 100.000 km² of customary land, partly in forest areas and areas assigned to oil palm plantations and mining. This is about 7% of the total Forested area. The areas covered by JKPP concern mostly thematic maps and community-boundaries in forest areas. The strategy is to involve local government and villages, getting methodologies recognised and resolving disputes. Base map content, obtained from BIG, is being used as reference and background for community mapping processes. As a basis for village mapping, JKPP uses Girik documents. These land records were administered under the former colonial regime. JKPP could retrieve many Girik documents. Sometimes they were heavily damaged. Many have disappeared while under care of authorities. The Girik document merely indicates an interest in a specific parcel, it is not formal proof of ownership.

The accuracy of community boundary surveys is around 4-15 meters (estimated positional error). Customary areas are surveyed by JKPP. Social data and drone data are being collected. The resulting maps show the community perspective on the boundaries. Mapping of forest areas often does not happen.



Boundaries between community area and area under authority of MoEF are often not clear. SOP's require MoEF land to be surveyed with geodetic quality and to be demarcated with wooden posts (patok). Currently MoEF land is only represented by general boundaries on 1:250.000 maps. More information about JKPP can be found at www.jkpp.org. However, this website is often not reachable.

AMAN

AMAN (Aliansi Masyarakat Adat Nusantara) aims to defend, protect and serve the interest of its members, the indigenous communities. They map Adat land and use standard operating procedures (SOP's) for their mapping activities. AMAN has issued several booklets to support para surveying and para legal activities. Participative mapping is one of AMAN's basic services. They provide knowledge, skills and training, they lend out equipment and provide basic data. AMAN sends map files to ATR/BPN. They use geographic coordinates and WGS84.



In 2011 an MOU was signed between AMAN and BPN. The purpose is to map communities in the Adat land. This covers land, but also includes rivers and coastal waters. There are three levels of governance of AMAN: National level, regional level and local chapters (117). All these chapters represent around 17 million individuals. AMAN uses the instrument of advocacy towards parliament and government, as well as direct action like demonstrations and boycotting. AMAN is financed by annual fees from the communities and international sponsors like the Ford foundation, Rainforest Foundation, Norway, UK, DIFID. There are also, partnerships with the Government.

Until now 83.000 km² have been mapped by organisations associated with AMAN. This is about 7% of the total Forested area. The Adat boundaries are considered as 'indicative'. The ancestral domain is fixed on the outside, but inside the domain land use arrangements are quite fluid, these are dynamic systems. The ambition of AMAN is recognition by the government, sustainable land use planning, integration with spatial planning at district level. More information about AMAN can be found at <http://www.aman.or.id/> and <http://www.aman.or.id/peta/>

JKPP and AMAN have each captured community boundary information of around 7% of Indonesia's traditionally managed land.



MCA

The MCA project is part of the overall Create Prosperity project which ends April 2018. The project aims specifically at sustainable resources and renewable energy. MCA has four major activities:

Village boundary and resource mapping

Compilation of thematic base maps in 41 districts (out total of 500-600) and 11 provinces (out of total of 34).

Inventory of permits and licences/concessions issued by national/province/district level authorities

Capacity building at provincial and district level for the spatial planning process including an information management system and to promote consistency in Permitting and licencing in relation to spatial planning.



There is always a BPN member on the delineation team. BPN planning is not the same as MCA planning: BPN aims at targeted certification projects. Boundaries are identified using politico-social experts (local, international) and technical consultants (local, international). Ideally, Adat boundaries and village boundaries are the same thing, but this is not always the case. District level authorities indicate to MCA which village boundaries they want to be surveyed. The information is accommodated across 6 Ministries. MCA is working on overlapping administrative and ancestral domains. The starting point of AMAN are community interests, for MCA the starting point is policy. More information about MCA can be found at <http://www.mca-indonesia.go.id/en/project/green-prosperity>



Annex 3: Background information and general statistics

General Institutional framework

As mentioned in the introduction, land registration responsibilities are distributed across the MoEF and ATR/BPN. MoEF is responsible for the registration of ancestral domain boundaries, located in forest area whereas ATR/BPN is responsible for the registration land boundaries in non-forest area. Of the total Indonesian forested land surface, about 45% is subject to ‘Adat’ or communal land administration traditions. These areas are mainly located in areas under formal Land Administration and management responsibility of MoEF. The Ministry of Home Affairs (MoHA) together with BIG are responsible for the registration of administrative boundaries. These boundaries are an essential precondition for efficient and effective execution of government and public administration responsibilities.

In some parts of Indonesia MoEF contracted the Millennium Challenge Account (MCA) to map administrative boundaries. The MCA project is part of the overall Create Prosperity project which ends April 2018. The project aims specifically at sustainable resources and renewable energy.

Badan Informasi Geospasial (BIG) is the National Mapping Agency in Indonesia. BIG is responsible for providing the topographical base map. BIG services include planning, mapping efforts and national georeference system, geospatial innovation, aerial imagery, and the provision of land information portals.

Adding to these Ministries a whole range of governmental departments, on both national and regional level, have the authority to grant concessions to parties to exploit natural resources. Land use planning takes place at national, district and municipal levels, as well as at ancestral community level. Land taxation is a district level responsibility. Land valuation also takes place at district level. The associated land information is scattered and fragmented across these departments and will be included in the One Map effort.

In addition to formal Land Administration entities, several Civil Society and other Non-Governmental and international sponsoring entities play a role in collecting Land Information in Indonesia. These include JKPP, AMAN for collecting Adat-type communal land use planning and community boundary information and MCA for collecting administrative boundary information. These NGO’s started with projects for participatory mapping, because of several reasons:



- weak implementation of Law No.26/2007 on the decentralisation of Spatial Planning;
- overwhelming power of international investors;
- lack of dialogue among stakeholders at the district and provincial level;
- lack of a formal mechanism that allows the participation of communities in spatial planning.

Land data structures

During our research, various existing land right categories were identified. Based on our interviews with the Gerik KAKAP Cadastral Administration, these can be categorised as:

Main land-rights:

- Government/State land
- Adat land (Ancestral domain land)
- Private land
- Concessions

Private land rights are categorised in different types:

- Rights of Ownership (Hak Milik)
- Rights of Cultivation (Hak Guna Usaha)
- Rights of Building (Hak Guna Bangunan)
- Rights of Use (Hak Pakai)
- Rights to Manage (Hak Pengelolaan)
- Rights for Religious Land (Hak Wakaf)
- Strata Titles (such as Condominium (Milik Atas Satuan Rumah Susun)
- Mortgages Rights (Hak Tanggungan)

Zoning categories for PIBT parcels

Land use planning categories that were identified with respect to our own research and the Gerik KAKAP pilot:

- Conservation Area (Kawasan Lindung)
- Areas that provide protection of the area below (Kawasan Lindung yang memberikan perlindungan kawasan dibawahnya)



- Local Protected Areas (Kawasan Perlindungan Setempat)
- Natural Reserve Area, Natuurbeheer en Erfgoed (Kawasan Suaka Alam, Pelestarian Alam dan Cagar Budaya)
- Other Protected Areas (Kawasan Lindung Lainnya)
- Aquaculture zone (Kawasan Budidaya)
- Production Forest zone (Kawasan Peruntukan Hutan Produksi)
- Agricultural zone (Kawasan Peruntukan Pertanian)
- Market Gardening Zone (Kawasan Peruntukan Perkebunan)
- Fishing Zone (Kawasan Peruntukan Perikanan)
- Mining Zone (Kawasan Peruntukan Pertambangan)
- Industrial zone (Kawasan Peruntukan Industri)
- Tourism Zone) Kawasan Peruntukan Pariwisata
- Settlement Zone (Kawasan Peruntukan Pemukiman)
- Trade and Service Zone (Kawasan Perdagangan, Jasa, & Fasum)

Related to the land ownership certificate is the certification by the Kepala Desa (village chief) that the land as it is mentioned on the certificate is located within his jurisdiction. Implicitly, the certificate issued by the Kepala Desa is a legal instrument justifying land ownership. The certificate from the Kades is the first phase that must be accomplished by the land owner in applying for a land certificate (Sertifikat Tanah). The latter is issued either by the “Camat” as the officer of the PPAT (Pejabat Pembuat Akte Tanah) or the National Land Board (Bandan Pertanahan Nasional/BPN). In other words, the certificate from the Kepala Desa is basic consideration for the “Camat” or the BPN for the issuance of a land certificate (Sertifikat Tanah) which is the strongest evidence of land ownership.

General Statistics (per 2017Q1)

Indonesia’s land surface roughly measures 1.9 million km². This is distributed across 6000 inhabited islands. Administratively Indonesia is divided into 34 provinces, 98 municipalities, 416 districts, 7160 sub-districts, and 74.754 villages. Demographically, Indonesia has around 260 million inhabitants including 300 native groups speaking more than 700 languages and dialects. Around 54% of Indonesians lead urban lives, rising to an expected 67% by 2050.



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BPN Survey Department

# KKP parcel target 2017	= 5.000.000
# land transactions/year	= 1.200.000
Parcel mapping cost	= 30US\$ per parcel
Additional certification cost	= 35 US\$
# BPN surveyors	= 750
# 2017 lic surveyors available/req	= 800/10.000
Certified/uncertified parcel ratio	= 20% certified
# BPN-surveyed indigenous land	= 41.000 km ²
# Surat Ukur (survey certificates)	= 20.000.000
Guideline completion parcel certification=	between 38 and 75 days per parcel

JKPP

Social forestry km ² assigned	= 126.000 km ²
JKPP area km ² mapped	= 100.000 km ² partly forest, partly palm oil & mining
Min Forestry authority %	= 50 %
Min Agriculture authority %	= 50 %
# Members JKPP	= 100+
Cost JKPP mapping	= 1.400 euro
Average community	= 47 km ²
Average family plot m ²	= 2.500 m ²
# Villages in Indonesia	= 7.500
Ratio recognised/indicative villages	= 25/75 %
% village boundaries certified	= 15%
Forest land boundary accuracy meters in reality	= 1:250.000 maps (0.2 mm boundary lines equivalent to 50 meters in reality)

AMAN

# Aman chapters	= 117
# Aman coverage individuals	= 17.000.000
Aman mapped km ²	= 83.000 km ²
Aman potential km ²	= 840.000 km ²



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Ancestral Doman MinFor/MinAgr = 70/30 %

BIG/JKPP

JKPP maps under BIG km² = 100.000 km²

JKPP maps under Forestry km² = 78.000 km²

JKPP maps under BIG = 213

JKPP map accuracy = 4 – 15 meters

MCA

MCA village demarcations = 414 in 4 districts

The **administrative hierarchy** of each tax parcel is:

Territory of Indonesia à Province à Regency à District à Village à Desa à Parcel



Annex 4: General Legal Framework

A description of the legal setting on land administration in Indonesia is provided per field visits and a factsheet from LANDac (2016). They found that Indonesian land policy is derived from existing legislation as well as memos providing technical guidance for policy implementation. They stress the legal framework is highly sectorial and compartmentalized, as mentioned in this report as well.

The most important legislation is summarized by LANDac in the table below. The Basic Agrarian Law (BAL), Law No. 5 of 1960 aimed to create one land law and abolish the dual Dutch and Indonesian system and to promote land reform. BAL allows only for the recognition of individual rights. The Basic Forestry Act of 1967 classified 70 per cent of Indonesia’s land area as state forest land, not subject to agrarian law. As described by LANDac, customary land law is known as Adat, which governs Indonesia’s traditional communal land tenure system. It is essentially a communal approach to regulating land rights and varies widely across the large archipelago. Legal pluralism is the norm in rural areas, i.e. the coexistence of the national state law with Adat. Adat land occurs mainly in forested areas. Per the Joint Ministerial Regulation IP4T (79/2014) community rights in forest areas should be respected by the Indonesian government.

Law	Content
Basic Agrarian Law (BAL or UUPA), Law No. 5 of 1960	Defines the fundamental types of rights that may be held by private individuals and entities; Describes the role of the state with regard to its direct use of land as well as its regulation of private rights and private uses of land; Article 5 of the BAL states that Indonesia’s agrarian law is <i>adat</i> law, or Indonesian customary law, as long as it does not conflict with national interests or other regulations set out in the BAL; Ultimately directed at the individualization of land tenure in Indonesia.
MPR Decree No. IX of 2001 on Agrarian Reform and Natural Resources Management	Instructs the highest house of the legislature (the MPR, <i>Majelis Permusyawaratan Rakyat</i>) instructs the main house (House of Representatives, <i>Dewan Perwakilan Rakyat</i>), and the president to harmonize laws related to use of land and natural resources to promote equity, human rights and sustainable development.
Spatial Planning Law (Law No. 24) in October 1992	Defined spatial planning and provides the guidelines of plan-making processes, plan implementation and control at national, provincial and local levels; Mainly aims at the rational and appropriate utilization of natural resources and man-made resources and at regulating the utilization of protected regions and cultivation regions; Contains specific provisions with respect to rural regions and urban regions.
Spatial Planning Law (Law No. 26 of 2007)	Amendment of the 1992 law (see above). Links with the decentralization laws and stipulates explicitly the authority of provincial governments (<i>pemerintah provinsi</i>); and of district governments (<i>pemerintah kabupaten</i> and <i>pemerintah kota</i>) in spatial planning; Also covers rapid urbanization occurring in Indonesia, particularly in the Greater Jakarta Area.

(Mitchell et al. 2004; Fitzpatrick 1997; Lindsey 1998; Rukama 2008; Faolex 2016)

Table 3: The legislation closely governing participatory mapping



Legal framework for land administration through community participation

ATR/BPN has identified the laws required for land administration through community participation by using aerial photographs and high-resolution satellite imagery to accelerate land registration:

- Law No. 5 of 1960 on Basic Agrarian Law
- Law No. 11 of 2008 on Information and Electronic Transactions
- Law No. 14 of 2008 on Public Disclosure
- Law No. 4 of 2011 on Geospatial Information
- Presidential Regulation No. 63 of 2013 Concerning the National Land Agency
- Ministerial Regulation No. 8 of 2015 on organization and administration of the Ministry of Agrarian and Spatial Planning and the National Land Agency
- Government Regulation No. 24 of 1997 on Land Registration
- Ministerial Regulation no. 3 of 1997 on implementation of Land Registration.
- Ministerial Regulation No. 11 of 2017 on licensed surveyors
- Ministerial Regulation No. 12 of 2017, on acceleration of systematic land registration



Annex 5: Parcel regularisation process

Regularisation is a labour-intensive process that requires legal, technical, social, cultural qualities of the staff involved. The reconciliation process consists of several steps. Every parcel described by a Surat Ukur survey document starts out with the status ‘documented’. In this phase, it is researched whether the document is authentic and specific enough. Once the authenticity is assured and the content accepted as specific enough, the status is ‘documented’

The next step is the delineation of the locally surveyed geometry on a cadastral map (the KKP map) using an ortho-photo image as background. The delineation should coincide with the actual use and geometry of neighbouring parcels. Cadastral survey logic does not allow for overlapping or underlapping of cadastral boundaries. If this happens, the regularisation process stops until more data is acquired to rectify or explain the over/underlaps. Parcels that get through this phase are indicated as ‘delineated’.

If delineated parcels do not create over/underlaps, they are related to the actual usage situation. This should match the delineated parcel within specific tolerances regarding boundary shifts and associated changes in parcel surface. Passing these tolerances, a parcel is accepted and indicated as ‘surveyed’.

Surveyed parcels can become registered once the relationship between a specific subject and object is established. This requires adequate documentation on such aspects as marital statuses and alienations that may have occurred over time: legal transaction, testaments, etc. Once the legal relationship is established, the object, subject and relationship between these can be established and indicated as ‘registered’.

Registered object-subject relationships must be validated at neighbour, community and state-levels. It must be made sure that no exclusive rights are obtained that constitute of a violation of legal individual or public rights and interests. Only after this is



Figure 2: Registration of parcels and their registration status



finally and adequately done, a subject can be adjudicated with real rights. The status will finally become ‘validated’.

	Validated	929,134 parcels
	Registered	20,839,684 parcels
	Surveyed/Measured	3,580,324 parcels
	Delineated	1,175,098 parcels

Source from query database on 24 August 2016, 05.50 PM

Table 4: Parcel registration status by August 2016

The regularisation process carries the risk of adjudicating formal land rights upon illegal or unjustified claims. The process requires careful, accurate, professional and just handling of the process. It intends to require much time and cost to complete each claim. Kadaster has implemented a regularisation project in Lesotho, where 60.000 land rights were regularised in five years against a cost of initially 100 US\$, later optimised to 50 US\$ per regularised object-subject relationship. An open source solution was used for the Land Information System in combination with terrestrial surveys and final certification. Although true participative methods were not used, it became clear that public involvement holds huge potential for improved communication on the process and acceptance of the results. It also showed that using imagery provides a more popular understandable and accessible process compared with actual terrestrial surveying. Using imagery in combination with visible boundaries instead of marked and surveyed boundaries increase production of land information, while reducing time and cost of the process.

In Suriname, a regularisation process is also underway, assisted by Kadaster advisers. Here too, the process requires balancing the effort required for creating legal certainty versus the time and cost associated with the process. It was decided by the authorities that only parcels assigned with a new national identifier have the final, ‘validated’ quality.

Other parcels can obtain this quality by full resurvey with the surveyor-generals quality check and consent. The approach is thus ‘sporadic’, not systematic. Parcels remain in the delineated/surveyed/registered status but legal transactions and usual land administration purposes (legal security, land use planning, valuation and taxation) can be served, even if the highest stage is not realised immediately but slowly over time.



Regulation process in Indonesia: improving tenure security through the land right validation process

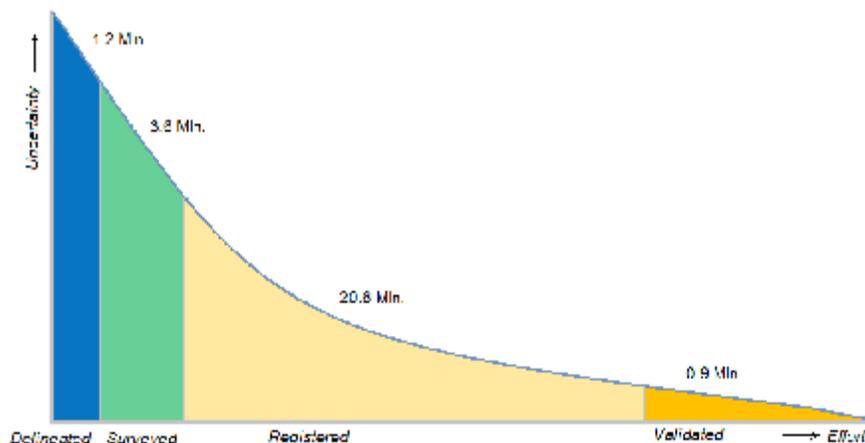


Figure 3: Production decreases when nearing advanced stages of registration

As can be seen in figure 3, only a small portion of the parcels in the process reach the ‘Validated’ stage. This is caused by the application of required due diligence principles to the process (completeness of underlying documents and statements, adequate research, prudence when drawing conclusion, application of the four-eye principle) and possible implications regarding legal status and individual interests. Thus, high levels of legal certainty are produced in the form of validated parcels. Ideally, all parcels (the 65 million ‘new’ parcels and the 45 million parcels to be regularised) should reach this validated or certified status in the shortest possible time against the lowest possible cost.



Annex 6: PIBT, PBT and certified parcel quality requirements

In 2017 ATR/BPN has compiled a Technical Guideline for land mapping through community participation ('Fit-for-Purpose Cadastre'). In this guideline, ATR/BPN defines two main quality types of parcel registration: the so called 'Peta Informasi Bidang Tanah / PIBT' quality and the 'Peta Bidang Tanah / PBT' quality. PIBT parcels are 'indicative' parcels, meaning they have only limited administrative value; they constitute no legal proof of the existence of land rights but provide useful land information for instance for the purposes of spatial planning, city services planning, logistics, disaster management, utilities management and support for One Map Policy. PBT parcels are 'certification ready' parcels, which means they have a quality that is acceptable as a starting point for the certifications process. PBT parcels meet internal ATR/BPN standards for certifications and are adequate for the valuation and taxation processes. Only after full certification, the quality of the owner (subject) parcel (object) and land-right (object-subject relationship) complies with legal procedures and standards providing maximum tenure security as reliable, authentic and authoritative land information.

The PIBT map is a thematic parcel map and provides at least an inventory on owners of the land or subjects who control the land. Therefore, high quality data (data with high accuracy) is not required for the PIBT map. The parcel boundary in the PIBT map is define as "indicative boundary" and no agreement or consensus is required among the neighbor . Instead, the PBT map consists of information of parcel boundary on formal ownership and therefore requires high quality data considered to be suitable for land right certification. The PIBTmap and the PBT map, as described by ATR/BPN, have qualities that suit particular purposes and therefore need to meet specific standards. PIBT is suitable for provision of baseline data to support policy development and land use planning purposes and meet the quality for land taxes purposes, while PBT suits these purposes as well but also land registration. A complete PBT map can be produced only when all required standards of ATR/BPN have been met.

ATR/BPN has conceived two types of land registration each with its' own procedure and associated data quality and purpose. For easy comparison, these are presented in the table below. It shows the essential difference the fast, cheap and low cost PIBT data set versus the complete PBT data set.



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Aspect	PIBT	PBT 'Lengkap' (= 'complete')
Formal Name	Peta Informasi Bidang Tanah	Peta Bidang Tanah
Administrative Coverage	Sub district/Village	
Data Content	Object Subject "Indicative Ownership"/control relationship Parcel Status Parcel use Parcel utilisation Parcel value Administrative boundaries Road Web Taxpayer Identification Number Subject Address Tax Object Selling Value Other Information Meta Data	Data quality meets ATRBPN Standards and meeting certification quality levels; Object Subject Ownership/control relationship Parcel Status Parcel use Administrative boundaries Other Information Meta Data
FFP Conformance	Fast, cheap/ low cost	Complete, high quality spatial data set
Technology	Satellite, Aerial and UAV imagery	
Methodology	Participatory identification and validation of boundaries	
Conflict Avoidance Control	Community participation	
Legacy Land Documents	Community participation	Community participation
Purpose	Baseline data to support policymaking and spatial planning	Integration into ATRBPN's computerised Land Administration system KKP (Komputerisasi Kegiatan Pertanahan) to support land administration, value zoning & spatial planning



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General Requirements	Quality uniformity, effectiveness, rapid and cheap complete land map	
Community involvement	<p>Socialisation</p> <p>Facilitation of communication</p> <p>Boundary identification</p> <p>Identified boundary delineation on maps</p> <p>Land data collection</p> <p>Publication</p>	
Budget Sources	<p>Through State Budgets:</p> <p>State Revenue and Expenditure Budget</p> <p>Local Government Budget</p> <p>Village Funds</p> <p>Through stakeholder Cooperation:</p> <p>Community Self Reliance</p> <p>Private Sector Social Responsibility Programs</p> <p>Census budget</p> <p>Village cooperation</p> <p>Public Private partnerships with banks etc.</p>	
Base Map Data Source Considerations	<p>Cost levels, Area coverage, Resolution, Content currency, cloud coverage, GCP marking, Envisaged map scale</p>	
Base map Requirements	Does not necessarily meet ATRBPN standards & specifications	Must meet ATRBPN standards & specifications
Base map Quality Control	<p>Previous correction activities or quality control required</p> <p>High resolution source imagery required</p> <p>Smallest map scale = 1:5000</p> <p>Previous correction activities or quality control required</p> <p>High resolution source imagery required</p> <p>Smallest map scale = 1:5000</p>	
Certification Requirements	Not possible	<p>Geometric accuracy for urban = 0.3 mm x map scale</p> <p>Geometric accuracy for rural = 0.5 x map scale</p>



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		<p>GCP marking and GPS surveying required</p> <p>Radiometric correction required</p> <p>Geometric correction required</p> <p>Quality testing required</p> <p>Plotting of existing boundaries of registered lands required</p> <p>Implementation requirements:</p> <p>Identification of visible or physical boundaries.</p> <p>In the field identification</p> <p>Supplementary measurements quality depending on # boundary sides</p> <p>Executing officer involvement:</p> <p>Officer from line Ministry or ATRBPN</p> <p>Licensed Cadastral Surveyor</p> <p>Surveying/Mapping Company using Licensed Surveyors</p>
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Table 5: A comparison between PIBT and PBT map features



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Annex 7a: Parcel geometry capturing costs estimations

Main Quality	Geometry capturing method	survey cost		staff cost		total cost per parcel in \$	resolution and accuracy details; economy; assumption of an average 400 parcels/sq km on 2500 map and average 200 parcels sq km on 5000 map	
		cost per sq km in \$	cost per parcel in \$	cost per parcel in minutes	cost per parcel in \$			
general basemap	Uncorrected GPS		0,01	10,00		1,00	1,01	700 cm Standard phone/tablet accuracy cost 600 \$ production 50.000 parcels
PIBT 5000	Submeter GPS		0,06	10,00		1,00	1,06	100 cm Smartphone with Trimble R2 antenna cost 3000 \$ production 50.000 parcels
PIBT 2500	Sat Imagery, georeferenced	100,00	0,25	0,00		0,00	0,25	30 cm Digital Globe source to be acknowledged
general basemap	Sat Imagery, georeferenced	10,00	0,03	0,00		0,00	0,03	50 cm Airbus source is representative
general basemap	Standard aerial imagery, georeferenced	125,00	0,31	0,00		0,00	0,31	50 cm resolution
general basemap	Ultralight aerial Imagery, georeferenced	50,00	0,13	0,00		0,00	0,13	10 cm resolution
PBT 5000	UAV aerial Imagery, georeferenced	250,00	0,63	0,00		0,00	0,63	5 cm resolution
PBT 2500	Robin Portable LIDAR georeferenced	25,00	0,06	0,40		0,04	0,10	1 cm resolution cost 250.000 5yr depr production 4.000.000 parcels
general basemap	Aeromap reconnaissance Pod	125,00	0,31	0,00		0,00	0,31	5-50 cm resolution
general basemap	Othophoto tiles printed		2,00	10,00		1,00	3,00	40 cm resolution
general basemap	Total station observations		3,00	60,00		6,00	9,00	1 cm resol 5yr depr 50.000 \$ prod 15.000 parcels
general basemap								
PIBT parcel geometry capturing cost	minimum cost	10,00	0,03	0,00		0,00	0,03	The cost of capturing PIBT parcel geometry varies between 0,03 and 1,06 \$ per parcel
	maximum cost		0,06	10,00		1,00	1,06	
PBT parcel geometry capturing cost	minimum cost	50,00	0,13	0,00		0,00	0,13	The cost of capturing PBT parcel geometry varies between 0,13 and 9,00 \$ per parcel
	maximum cost		3,00	60,00		6,00	9,00	

Table 6: Parcel geometry capturing (base mapping) costs (green is cheapest; red costliest)



Annex 7b: Additional non-surveying (base mapping) cost estimations

Main Quality Aspect	Quality Requirements	survey cost		staff cost		total cost per parcel	remarks
		cost per sq km in \$	cost per parcel in \$	cost per parcel in minutes	cost per parcel in \$		
Base Map Geometry Management	Implementation method						
	Preparation, planning			2,40	0,24	0,24	one week per village of 1000 parcels by licensed
	Basemap Quality Control			2,40	0,24	0,24	one week per village of 1000 parcels by licensed
	Totals Base Map Geometry			4,80	0,48	0,48	
Participatory Boundary Identifier	Preparation, communication			2,40	0,24	0,24	
	Workmap visual boundary delimitation			8,00	0,80	0,80	office 80% of parcels
	Participative demarcation			0,00	0,00	0,00	
	Field identification			5,00	0,50	0,50	field 10% of parcels
	Field size determination			0,00	0,00	0,00	
	Supplementary observations			5,00	0,50	0,50	field 10% of parcels
	Boundary Quality control			2,40	0,24	2,40	one week per village of 1000 parcels by licensed
	total for participatory Boundary identification			22,80	2,28	4,44	
Participatory Acknowledgment	Preparation, communication			2,40	0,24	0,24	
	Owner identification			5,00	0,50	0,50	one week per village of 1000 parcels by licensed
	Neighbour consensus			5,00	0,50	0,50	
	Community review			1,00	0,10	0,10	
	Administrative boundary consistency			1,00	0,10	0,10	
	Verification control			2,40	0,24	0,24	one week per village of 1000 parcels by licensed surveyor
	Total for participatory Acknowledgement			16,80	1,68	1,68	
Formal Certification	Preparation			30,00	3,00	3,00	
	Legal document inspection			15,00	1,50	1,50	
	Existing parcel boundary consistency			15,00	1,50	1,50	
	Publication process			20,00	2,00	2,00	
	Final Adjudication			30,00	3,00	3,00	
	Total for certification			110,00	11,00	11,00	

Table 7: Additional base mapping cost estimations