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THE ROLE OF THE REVISED LAND ADMINISTRATION DOMAIN MODEL AND SPATIAL DATA INFRASTRUCTURE IN IMPROVING EASE OF DOING BUSINESS IN INDONESIA

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Abstract

Land management has four functions that are interlinkage to each other: land tenure, land valuation, land use planning and land development. These functions are the foundation of Indonesia's new strategy for improving its Ease Of Doing Business (EODB), directly in dealing with construction permits and registering property. Ideally, each permit includes Rights, Restrictions, and Responsibilities (RRRs) from land management functions. However, in a decentralization, it is difficult to manage RRRs sourced from different activities and managed by multiple data custodians. Our study applies the conceptual data modeling of spatial planning information in the revision of ISO 19152 on the Land Administration Domain Model (LADM) to ensure the interoperability of RRRs information. This paper is focus on how to establish interoperability of land information and disseminate to enable economic actors in doing complex tasks such as issuing business license and registering properties.

Key Words:

LADM, EODB, Land use planning, RRRs, Spatial Data Infrastructure

1 Introduction

Since 2002, the World Bank publishes the Ease of Doing Business (EODB) reports to provide an objective measure of regulations regarding business and its implementation worldwide[1]. In 2020, this annual report covers twelve indicators of business regulation at national and sub-national (cities) levels. Two of them are: Dealing With Construction Permits and Registering Property indicators for describing how efficient investors or start-ups are getting the location permits, registering properties, and having a permit for constructing facilities for their businesses (World Bank 2014). The scope of property in EODB's registering properties is focused on immovable properties (i.e., land or constructions). Authorities in many countries are using the Land Administration System (LAS) as the primary tool for acquiring information, securing property rights, enabling public investment planning, and improving productivity and growth of the area. LAS consists of geographic data (e.g., land parcel boundaries) and non-spatial data that describe the relationship between land and peoples (ISO 2012). EODB uses five parameters (reliability of infrastructure, transparency of information, geographic coverage, land dispute resolution, and equal access to property rights) to examine the quality of LAS in 190 countries.

In the year 2020, Indonesia ranked 73rd in EODB, with registering property performance is only at 106th, while dealing with construction permits stagnated at 110th (World Bank 2019). In Indonesia, a construction permit represents legality for property owners to build new, change, expand, reduce and/or maintain construction under administrative and technical criteria. The government of Indonesia (GOI) introduced digitalization and automation to improve transparency, services, performances, and outreach for improving ease of doing business. These efforts rely heavily on interoperability and standardization for facilitating multiple stakeholders in doing complex tasks such as registering property and issuing business permits. This paper is focused on how to establish interoperability of land information to integrate various types of land information for supporting the Online Single Submission (OSS) system to be fully operational for business licensing in a federated data management. It should be noted that this paper is multi-disciplinary covering topics, such as spatial planning, land administration, doing business, legislation, and information infrastructure, to name a few. We, therefore, spend some time to introduce our terminology, which is based (when possible) on ISO standards. LADM acknowledges a land parcel as an alias of spatial units which contains information representing an area of land (including water) or volume of space (ISO 2012).

The International Federation of Surveyors' (FIG) vision of Cadastre 2014 encourages countries to provide a complete overview of the legal aspects of land (Kaufmann & Steudler 1998). Indeed, a modern LAS

[1] https://www.doingbusiness.org/en/about-us

must be capable of supporting the four functions of land management (land tenure, land valuation, land use, and land development) (Enemark et al. 2005). A modern LAS manages spatial representation and documents containing Rights, Restrictions, and Responsibility (RRRs) for landowners, authorities, prospectus investors, and broader society. Indonesia's legal frameworks delegate land management functions to multiple ministries and local governments. Thus, LAS should be built on federated systems that rely on three factors: a) institutional arrangements with quantitative measures, b) information interoperability, c) a robust common data platform for ensuring data sharing and information streaming. In 2012, The International Standards Organization (ISO) published ISO 19152:2012 on The Land Administration Domain Model (LADM) to provide a common conceptual model for developing an ontology, which is essential for creating information interoperability and developing (or improving) LAS (Lemmen et al. 2011).

In 2017, FIG/ISO established a working group for evaluating and refining the LADM standard. The spatial planning information package was proposed in ISO's working group meetings (Lemmen et al. 2019). Van Oosterom et al. (2009) noted that LAS is an indispensable part of the SDI, and the UN recommends two layers in land management (land parcels and land use) as fundamental geospatial data themes which countries should have (UN 2018). Many studies recommend standardization and data sharing in improving the effectiveness of land management (Harvey et al. 1999, Kalantari et al. 2006, Herold et al. 2006, Lemmen et al. 2011, and Würriehausen et al. 2014). In the next section, we present the relationship between land information and EODB. Section three shows how standardized land information can support Indonesian authorities in issuing certificates and permits. LADM and its implementation in Indonesia will be discussed in section four. We conclude this paper with recommendations on actions to be taken by authorities and future research.

2 EODB and Land Management in Indonesia

The World Bank publishes EODB to benchmark business regulations and practices in 190 countries. EODB project collects and analyzes quantitative data overtime for the past 18 years so that governments, journalists, business sectors, and academics can perform data-driven decisions and policy-making concerning the business environment of each country. The World Bank (2019) establishes doing business principles based on the assumption that business can grow from clear rules, robust property rights, facilitation of commercial disputes, and protection against arbitraries and abuses. The EODB encourages countries (and cities) to make their rules and regulation efficient, transparent, and clear to follow. The Doing Business 2020 report portraits twelve indicator sets of the regulatory set that influence private

sectors (World Bank 2019) which ten of them (starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency) are used to rank countries (Figure 1). This paper focuses on dealing with construction permits (DWC) and registering property (RP), as they have a direct relation with land management. It should be noted that also some of the other indicators have strong links with land management; e.g., Getting credit (as quite often LAS are used to register mortgages) or Paying taxes (as quite often LAS are used to register the property values) showing the importance of LAS on EODB.

Figure 1. Twelve indicator sets measured in Doing Business (World Bank 2019). This paper discusses Dealing with construction permits and Registering property (Blue).

The World Bank (2019) measures procedures, time, and cost required for the business to complete all formalities to get DWC permits and RP. In most countries, business actors must obtain construction permits and register their land/property before applying for a business license. Doing Business 2020 gathered information on the accessibility of zoning regulation (detailed spatial plans), building regulation, and complete sets of building codes to gauge restrictions and responsibilities. In the section DWC of the questionnaire, the World Bank introduces integration with GIS data and a multidimensional (2D/3D) representation, including Building Information Modeling (BIM) and whether countries utilize digital files, online platforms, and open standards. This information then being used as a reference in supervising, inspecting, and quality control in the construction project. The World Bank includes land registration (RP) as indicator sets of Doing Business Index to measure the procedure, time, and cost in transferring land/property. To examine the quality of LAS, the World Bank examines the reliability of infrastructure, transparency of information, geographic coverage, land-related dispute resolution, and equal access to property rights. The reliability of (information) infrastructure index is regarded as what types of data and how information is managed in the LAS, utilization of geoinformation technology, the existence of operational information infrastructure (i.e., NSDI) to facilitate data sharing. Transparency of information index represents ease of obtaining land information and the existence of interface or services with a

sufficient degree of usability. Completeness of land information is represented by geographic coverage index. Data gathered in the questionnaire is regarded as sufficient detail for global observation, but developed countries may have other methods in assessing the quality of their LAS in a more comprehensive way (UNECE 2005).

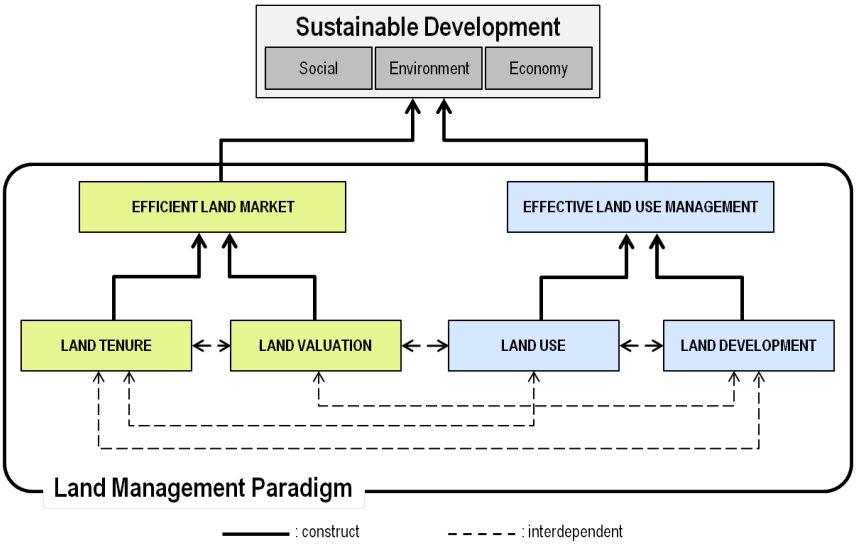


Figure 2. A global perspective of Land Administration Systems (Enemark et al. 2005).

ISO (2012) defines land administration as a "process of determining, recording, and disseminating information about the relationship between people and land." Enemark et al. (2005) state that a modern LAS should comply with the land management paradigm by covering four aspects: land tenure (and cadastre), land value, land use, and land development in a more standardized, multifunctional and interdependent way (Figure 2). Information gathered in both the land tenure (registration) and land valuation processes are essential in developing an efficient land market (Wallace & Williamson 2006). At the same time, land use maps and land development (spatial plan) documents will be used to develop effective land use management (see Figure 2). Land tenure (and land registration) collect data about rights on land or properties. Land valuation collects data concerning the valuation of rights (land price, transaction price, and mass valuation). Land use and land development planning construct zoning regulations that prescribe characteristics (privileges, prohibition, and obligations) on a specific area or space.

Antrop & Van Eetvelde (2000) argue that a holistic approach should consider the whole rather than the aggregation of composing elements. In Indonesia, the Spatial Management (Planning) Act mandates local

governments to develop the land use policy and to plan land development within their jurisdiction. The land management paradigm is suitable for Indonesia as the Ministry of National Development Planning will implement Holistic-Integrative-Thematic-Spatial (HITS) as a national approach to achieve Sustainable Development Goals (SDGs) and improving EODB indicator sets in 2020-2024 (Bappenas 2019). HITS encourages all level governments, businesses, and citizens to utilize land information, including site selection of public and private investments, executing and monitoring business performance and evaluating and planning for growth. Thus, HITS demands LAS be improved to manage not only land tenure but also land valuation, land use, and land development (spatial plans). Local governments utilize the Spatial Planning Act to integrate sectoral policies and to construct zoning regulations (detailed spatial plans). Therefore, the HITS approach requires each of the spatial units to have RRRs (Figure 3). Spatial Planning Act regulates each phase of spatial planning practices (creating detailed spatial plans, permit systems, incentive/deterrent, and sanctioning violations) based on land rights and land allocation prescribed in the Basic Agrarian Act (See lines in Figure 3). Therefore, the availability and accessibility of land information are compulsory to perform such integration of policies from different sectors in spatial planning. Failure to develop interoperability and information infrastructure to relate land tenure, land valuation, land use, and land development with the rest of information about RRRs from all sectors may create delays and asymmetric information between government institutions, as well as for the rest of societies.

The legal framework in Indonesia specifies procedures in defining RRRs in Indonesian territory so that all stakeholders can use land and its resources safeguarded by legal protection. We identified eighteen types of land rights, eight types of restrictions, and six types of obligations resulting from the four aspects of land management in Indonesia (see table 1-3 in Appendix). The Basic Agrarian Principles Act mandated BPN to develop and maintain information from cadastral mapping, legal documentation, and land registration, which are used in zoning regulation, permit systems, incentive/disincentive, and sanction (see Figure 3). The Spatial Planning Act regulates the delegation of authority to the local government in developing the land-use plan and land development plan. Collaboration between BPN and local governments in determining zoning regulations permit systems, incentives/deterrents, including in land tenure, land use, and land development processes (see yellow boxes in Figure 3). Because of this setting, the country relies on interoperability and data sharing mechanisms. Therefore, Indonesian NSDI is the critical factor for making land information reusable for social, economic, and environmental purposes. The LAS was established in 1997 through the Land Office Computerization (LOC) project and will be

improved continuously by BPN[2]. The current version of LAS is the KKP-Web (Komputerisasi Kantor Pertanahan/KKP-Web), an online platform of Computerized Land Office (Pinuji, 2016). The KKP-Web manages georeferenced land parcel maps and registrations in a centralized database managed by BPN's main office in Jakarta.

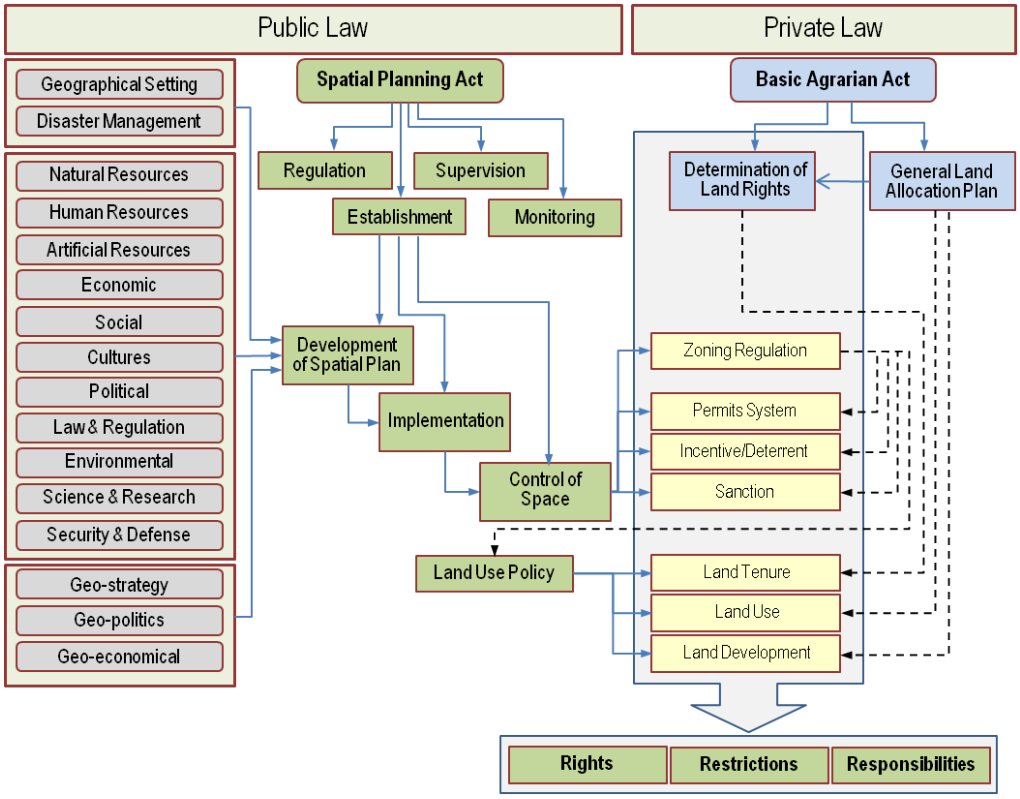


Figure 3. RRRs derived from Public and Private laws in Indonesia under the Spatial Planning Act (2007) and the Basic Agrarian Principles Act (1960). Blue lines represent regulating, and Dashed Black Lines represent referencing. Land information from public laws is maintained within ministries and local governments (green boxes), while National Land Agency manages RRRs from land tenure and land valuation process (light blue boxes).

3 Standardization of Land Information in Indonesia

According to Enemark (2001), land information is a complete set of interest in land (RRRs) with geometric representation consisting of land ownership, land valuation (and taxation), land use planning, and land development. In general, countries and information communities recognize the importance of information, and technical interoperability as this enables stakeholders to cooperate, develop, integrate, and take action in the best possible way. International Standards Organization (ISO) and International Electrotechnical Commission (IEC) (2015) defines interoperability as "*capability to communicate,*

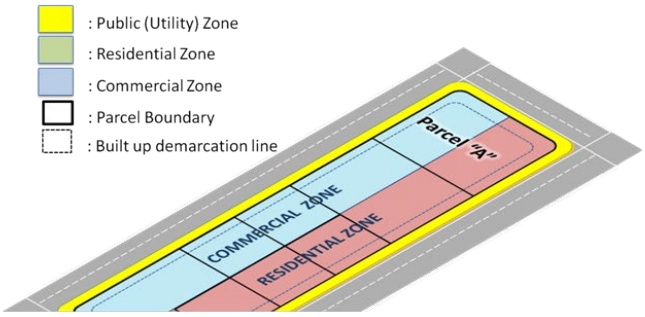
[2] https://www.atrbpn.go.id/Publikasi/Inovasi/Komputerisasi-Layanan-Pertanahan

execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units." As an online platform connecting multiple stakeholders doing complicated tasks, the Online Single Submission (OSS) system for requesting construction permits relies on interoperability for land information used within its database. In the digital era, interoperability is vital for making land information understandable, meaningful, machine-readable, and machine-actionable. They are three types of interoperability: informational, technical, and operational (Open Group, 2011). Operational interoperability relates to how business processes are to be shared. Specification on how information is to be shared is described in information interoperability. Technical interoperability deals with technical specification of services to be shared or among stakeholders. In this paper, we only discuss informational interoperability for the integration of RRRs information from spatial planning to support ease of doing business.

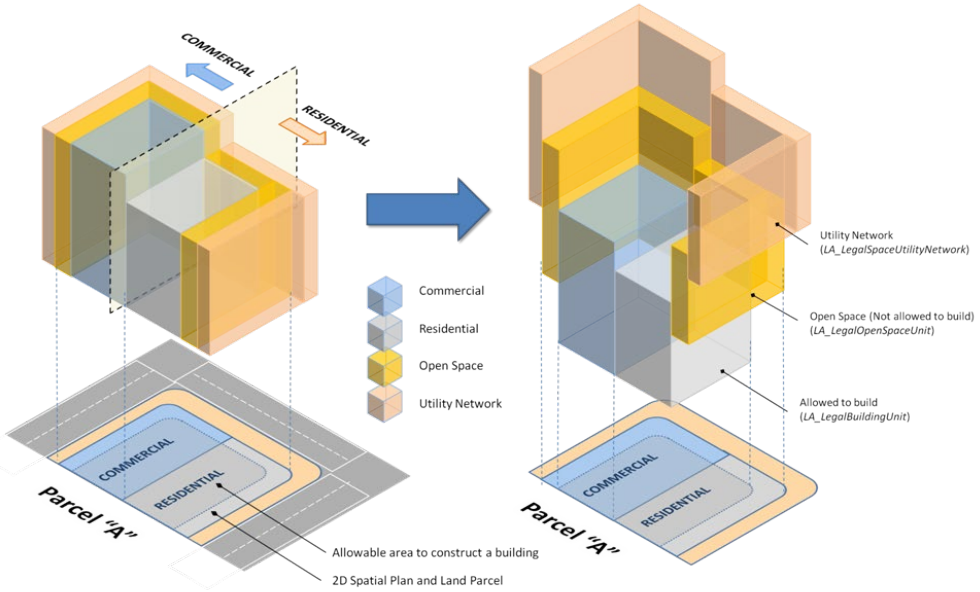
3.1 State of The Art of Standardization of RRRs information

Zoning regulation is a regulatory means to achieve sustainable development (UN Habitat, 2017). Most of the zoning regulations create RRRs in the form of preferred functions or activities for each land or space. LADM supports the exchange of information on RRRs in both centralized and distributed environments through a shared and consistent ontology and terminology for legal administrative, geometry, observation and measurements, and temporal aspects. Information interoperability can be developed on an extensible foundation by using LADM packages. This standard aims to make LAS efficient and effective to perform its duties (Lemmen et al. 2011). ISO (2012) defines rights as “activity or class of actions that system participant may perform on or using an associated resource,” while restriction determined as a “formal or informal obligation to refrain from doing something” and responsibility as a “formal or informal obligation to do something.” The administrative package of LADM provides the abstraction RRRs within three classes: *LA_Right*, *LA_Restriction*, and *LA_Responsibility*. Starting in 2017, ISO organized a working group to improve the existing LADM. This improvement will integrate four aspects of land management into the LADM standard (Lemmen et al. 2019).

The newly proposed Spatial Planning (SP) information package (Indrajit et al. 2020) attempts to resolve this situation by reusing of *LA_SpatialUnit* of the existing LADM class to represent specific zoning (including three-dimensional shape) within a land parcel. The existing LADM is capable of managing a multidimensional representation (geometry and temporal) of RRRs without gaps and overlaps (*LA_BoundaryFace* and *VersionedObject*).



a. Typical Zoning Regulation in an Indonesian city block



b. The implication of urban planning on a land parcel "A."

Figure 4. The element of spatial units in the proposed Spatial Planning Information Package (Indrajit et al. 2019)

In this paper, we focus on how to incorporate RRR information from the spatial planning process using LADM for allowing permits system as part of a national effort in improving doing business. RRRs information on land is never static: rights are transferred daily, while political dynamics and disasters stimulate policy changes in land use, land tenure, and land use planning (see Figure 4.a). In a city with a complex setting, the spatial planning process may split the land parcel if it has two or more RRRs (see Figure 4.b). Modern cities should consider land as a multidimensional (3D/4D) space, particularly in a sophisticated urban setting. Multidimensional views enable proper representation for underground Mass Rapid Transit or utility networks, elevated transportation networks erected above the surface, or time limitations in the use of land (e.g., time-sharing). This multidimensionality adds complexity to the RRRs information attached to a land parcel (spatial unit). This situation needs multidimensional representation

and visualization to avoid confusion among authorities, landowners, and investors.The European Union (EU) launched the Plan4All project in 2009 to study about common data model for land use and spatial planning in European countries (Murgante 2011). Later, in 2011, INSPIRE published guidelines for land use data specification (INSPIRE 2013). The Spatial Planning (SP) information package that is currently under review incorporates information that results from the spatial (or urban) planning process in order to improve the completeness of RRRs in LAS. By including the four aspects of land management mentioned above, the improved LADM will offer a complete reference model for representing the relationship between people, land (ISO 2012). The influence of spatial (urban) planning on property rights can be impactful by imposing restrictions (limitations) and responsibilities (obligations) on landowners and land users. Land use data model can be used as a reference for RRRs information, then integrated with land registration, land valuation, and land development. However, since many countries utilize land-use planning to incorporate RRRs from multiple sectors (i.e., social, environment, economy), interoperability must be achieved before integration into the LAS.

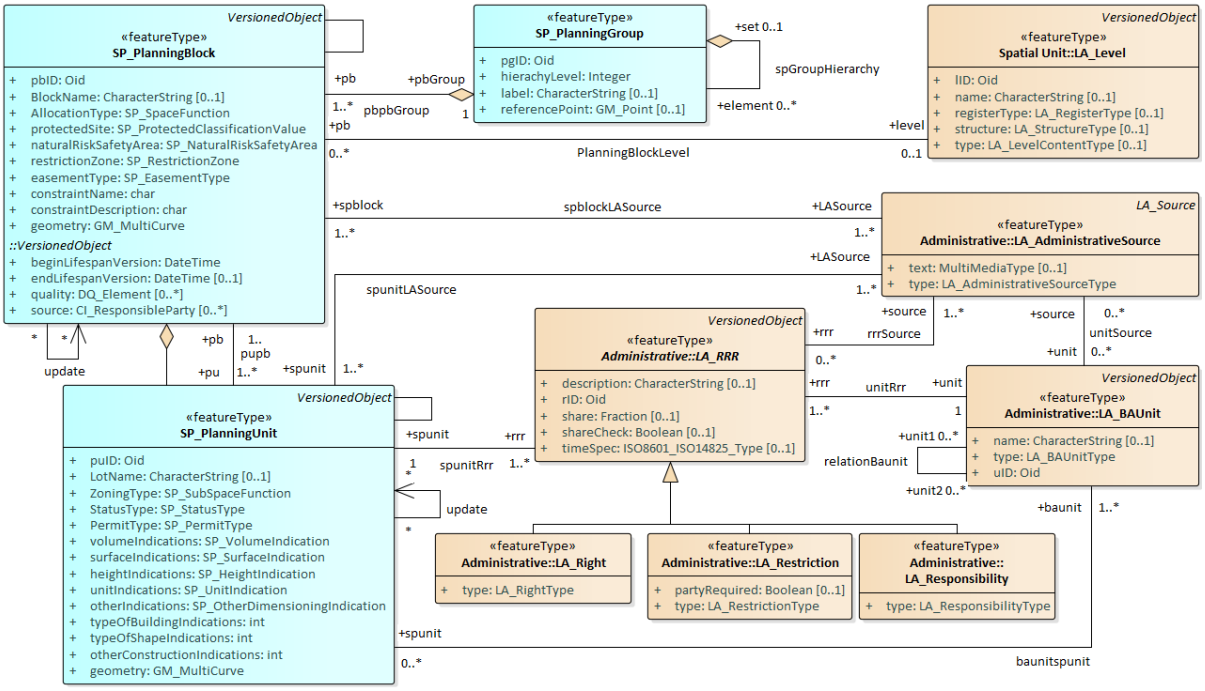


Figure 5. Classes in spatial planning information package (SP_PlanningBlock, SP_PlanningUnit, and SP_PlanningGroup) and their relationship in constructing RRRs from spatial planning (Indrajit et al. 2020)

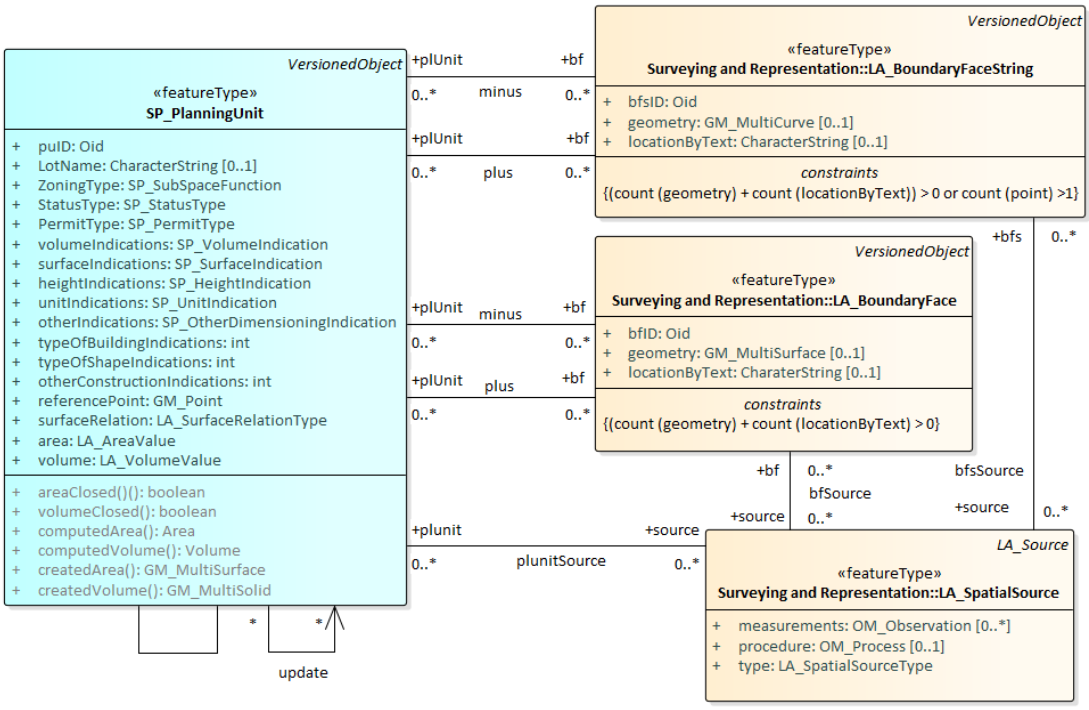


Figure 6. Geometry aspect in Spatial Planning Information. SP_PlanningUnit contains the geometry of the zoning plan,

The proposed Spatial Planning Information Package contains RRRs derived from spatial planning processes. Spatial planning information consists of three main classes: *SP_PlanningBlock*, *SP_PlanningGroup*, and *SP_PlanningUnit* (see Figure 5). *SP_PlanningBlock* facilitates spatial plans from the upper hierarchy, while *SP_PlanningUnit* contains more detailed indications for constructing RRRs for each land parcel (see Table 1 and 2 in the Appendix). Both classes contain geometry. *SP_PlanningGroup* represents a hierarchy of spatial planning (e.g., national spatial plan, state/province spatial plan, and city spatial plan). *SP_PlanningBlock* and *SP_PlanningUnit* may be used as a reference for supplementary regulations containing legally-binding documents (Indrajit et al. 2020). Zoning plans prescribe RRRs with geometric specifications. The working group of LADM proposed a spatial planning information package to incorporate RRRs information from spatial planning processes. Authorities may use geometry from *SP_PlanningUnit* as reference for the criteria of a specific permit (see Figure 6). With interoperability, land information can be integrated for multiple purposes as well as can be used by multiple stakeholders. ISO (2012) encourages leading agencies from all countries to develop and improve provide several LADM country profiles. The extensification classes proposed by Paasch et al. (2015) can be used to integrate RRRs information sourced from public and private laws. Experts shall develop a standardized code list required in LADM, including RRRs information.

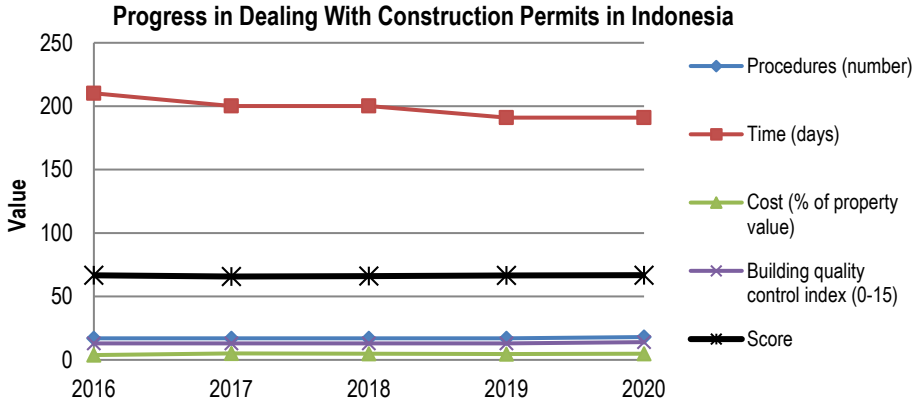


Figure 7. Dealing with Construction Permits in Indonesia 2016-2020. Source: Doing Business Report 2016-2020 (World Bank 2015-2019)

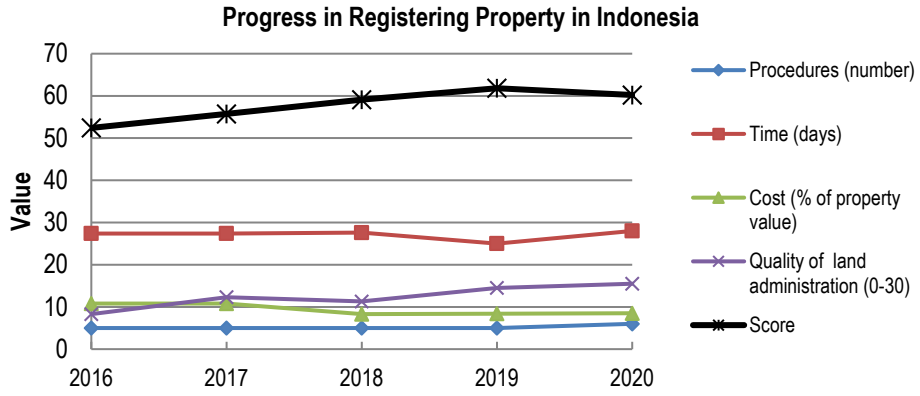


Figure 8. Registering Property in Indonesia 2016-2020. Source: Doing Business Report 2016-2020 (World Bank 2015-2019)

3.2 Indonesia's Position in Registering Property and Dealing with Construction Permits

With a coverage of large-scale topographic maps (at scale 1:5,000) as low as 2% (7563 from 370,261 maps in the year 2019) (Abidin 2019), while RDTR (zoning regulation/detailed spatial plans) at map scale 1:5,000 is available only at 2.2% (45 from 1,800 areas in the year 2018)[3]. It is a massive challenge for Indonesia to provide adequate data for improving the registering properties and dealing with construction permits indicator sets. These conditions are indeed reflected in the Doing Business reports, where Indonesia's performance for dealing with construction permits is suspended in the same position for the past five years (see Figure 7). Figure 8 shows a similar condition for dealing with construction permits. From 2016-2020, it took 18 steps in 200 days for a business to obtain a construction permit in Indonesia (see Figure 7) (World Bank 2015-2019). Figure 8 shows that the process of registering property in the

[3] https://properti.kompas.com/read/2018/09/21/173650121/baru-45-rdtr-yang-sudah-jadi-raperda

land register needs six steps within 28-31 days. Consequently, Indonesia's rank in these two indicators has not significantly improved.

In respond to this situation, Government of Indonesia (GOI) initiated many key policies for arranging land management to stimulate doing business, including modernization of LAS, strengthening the National Spatial Data Infrastructure (NSDI), accelerating large scale topographic and cadastre mappings, and facilitating local governments in compiling the Detailed Spatial Plan (Rencana Detail Tata Ruang/RDTR)[4]. President Joko Widodo is strengthening his national economic strategy with geospatial information by promoting One Map Policy (OMP) into the 8th of Economic Stimulus Package Policy in the year 2016 (OECD, 2018). In February 2018, GOI initiated the Comprehensive Systematic Land Registration (Pendaftaran Tanah Sistematik Lengkap/PTSL) program to accelerate land registration and cadastral mapping across Indonesia[5]. Through PTSL, GOI attempt to register and to issue a land certificate for 126 million parcels by 2025. LAS is projected to manage 62.4 million land parcels (50% of total), and PTSL contributed 18 million certificates in 2019. Ministry of Agrarian Affairs and Spatial Planning (Min. ATR) cooperates with Geospatial Information Agency (BIG) will facilitate local governments by accelerating the compilation of RDTR in 57 more locations within six months in the year 2020[6]. This cooperation will be extended for developing standards and ensuring Quality Control on RDTR[7]. Also, the World Bank is aware of these crucial needs and assists countries in need, for example, through the One Map Project in Indonesia and East Asian countries[8]. In 2017, Indonesia formally adopted LADM as the national standard, but BPN was already implemented the LADM five years earlier within its KKP systems. BPN uses a conceptual model specified in LADM to store parcel boundaries and land registration. By using LADM, BPN aims to avoid data redundancies and, at the same time, by the enforcement of a single reference system in its database. The Spatial Planning Act (2007) mandates that local governments develop the Spatial Planning Information System (Sistem Informasi Manajemen Penataan Ruang). The Spatial Planning Regulation (2010) specifies the functions of this system to manage information and documentation related to spatial planning and to facilitate stakeholders for accessing spatial planning information.

[4] https://jdih.setkab.go.id/PUUdoc/175445/Inpres%20Nomor%202%20Tahun%202018.pdf
[5] https://www.atrbpn.go.id/Publikasi/Peraturan-Perundangan/Peraturan-Lain/instruksi-presiden-nomor-2-tahun-2018-74878
[6] https://tataruang.atrbpn.go.id/Berita/Detail/3489
[7] https://www.atrbpn.go.id/Berita/Siaran-Pers/dukungan-ketersediaan-basis-data-untuk-kemudahan-aksesibilitas-peta-rtrw-76892
[8] https://projects.worldbank.org/en/projects-operations/project-detail/P160661?lang=en

3.3 Sharing RRRs through Spatial Data Infrastructure

GOI launched an Indonesian NSDI in 2011 to facilitate ministries and local governments in sharing spatial information. Data infrastructure is aiming to establish a supportive environment for stakeholders to share and re-use their information (Van Loenen 2006). Spatial data governance on land information and doing business is regulated primarily in Public Information Disclosure, Spatial Planning Act, and Geospatial Information Acts. These Acts instruct governments to develop an information system for managing land information and publish them as public information to society. In 2014, President Susilo Bambang Yudhoyono decreed SDI regulation to allow citizens to access and contribute spatial data into NSDI systems[9]. Knowing land information is needed not only in achieving SDGs but also for accelerating economic activities, GOI is planning to extend One Map Policy (OMP) to incorporate large-scale topographic mapping to support land management and spatial planning[10].

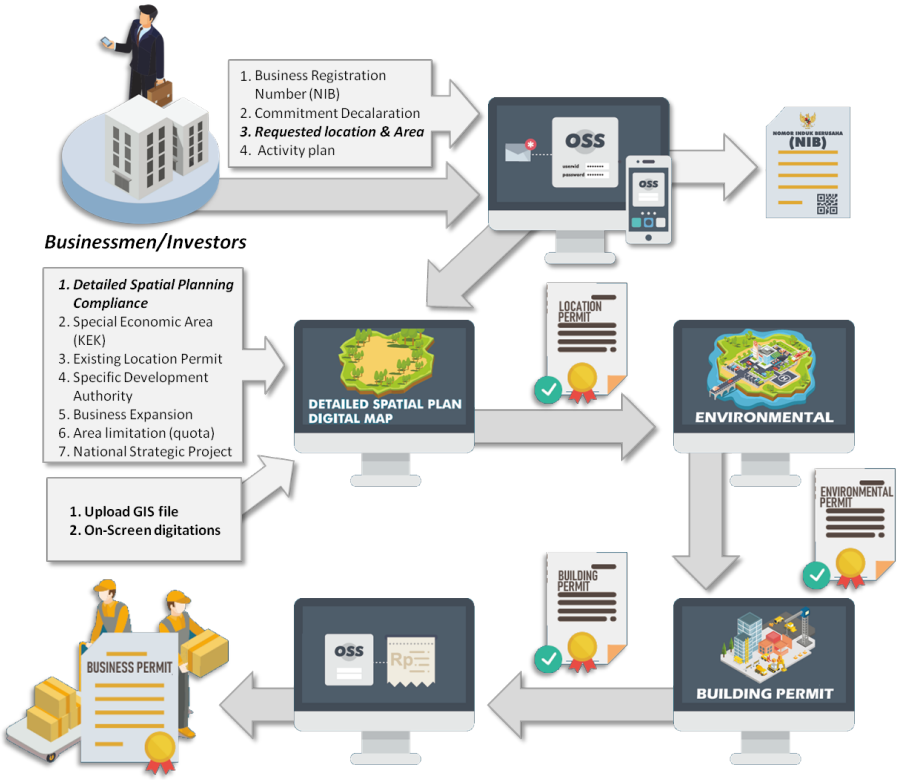


Figure 9. Generalized overview of land information in the One Single Submission (OSS) system in issuing the business license (Ministry of Trade-Republic of Indonesia, 2018).

[9] https://jdih.big.go.id/lihatdoc?id=3970
[10] https://satupeta.go.id/news-detail/24

In 2018, President Joko Widodo launched the Online Single Submission (OSS), an online and integrated platform connecting various sectors for issuing a permit or licensing for business and investment[11]. The OSS is the single national gateway for business licensing. The OSS agency maintains the system with ministries and local government support. RRRs information is the core data in issuing location (including water usage), environment, and building permits sourced from the land administration and the detailed spatial (city/municipal) planning. Investors, business owners, and land-owners can use this platform by providing the proposed location with administrative documents (Business ID, current permit, activity plan, and commitment declarations) and spatial information (land parcel and address); see Figure 9. When requesting a business license, investors are required to declare a commitment to comply with restrictions and responsibilities imposed on designated land (or space) resulting from the applicable by-laws and regulations.

The OSS system facilitates authorities to evaluate the compliance of the proposed location with RDTR (Detailed Spatial Plan), land registry, and environmental regulations (see Figure 9). Land Tenure and RDTR recommends RRRs for landowners and economic actors in carrying out business activities on each land parcel or space. The OSS will facilitate local governments in issuing a location permit by examining whether the proposed location complies with zoning regulation as prescribed by the legal documents of RDTR. BPN will examine each of the proposed locations according to RDTR for issuing of land ownership rights. In cities and municipalities where zoning regulation has not been established yet, the OSS system provides second scenarios to issue business licenses without zoning regulation. GOI through The OSS agency will grant a location permit automatically if the proposed location is sourced from the economic authority or designated for the national strategic project[12], classified as a national strategic project, adjacent to the existing permit or within a Special Economic Area (Kawasan Ekonomi Khusus/KEK)[13]. For locations outside Specific Economic Zone (Kawasan Ekonomi Khusus/KEK), investors must submit Environmental Management Plan (UKL) and Environmental Monitoring Plan (UPL) and commitment to perform Environment Impact Assessment (Analisis Mengenai Dampak Lingkungan/AMDAL). Construction Permits (Izin Mendirikan Bangunan/IMB) and the Certificate of Building Proper Function (Sertifikat Layak Fungsi/SLF) will be given if investors or developers submit commitment for complying to criteria prescribed in Government Regulation on Building[14]. Local

[11] https://oss.go.id/portal/home/download/pdf/PP-24-2018-OSS-dan-Lampiran-HVS
[12] https://sipuu.setkab.go.id/PUUdoc/175532/PP%20Nomor%2024%20Tahun%202018.pdf
[13] http://jdih.pu.go.id/internal/assets/assets/produk/PermenPUPR/2018/07/PermenPUPR19-2018.pdf
[14] https://peraturan.bpk.go.id/Home/Details/49491

governments will examine building utilization rights and certificates of proper function for releasing space utilization permits. As an online platform that connects multiple stakeholders performing complicated tasks, the OSS system relies on interoperability for land information used within the distributed database. Although the OSS is developed for attracting global investors, we did not find any source that leads to using multiple languages.

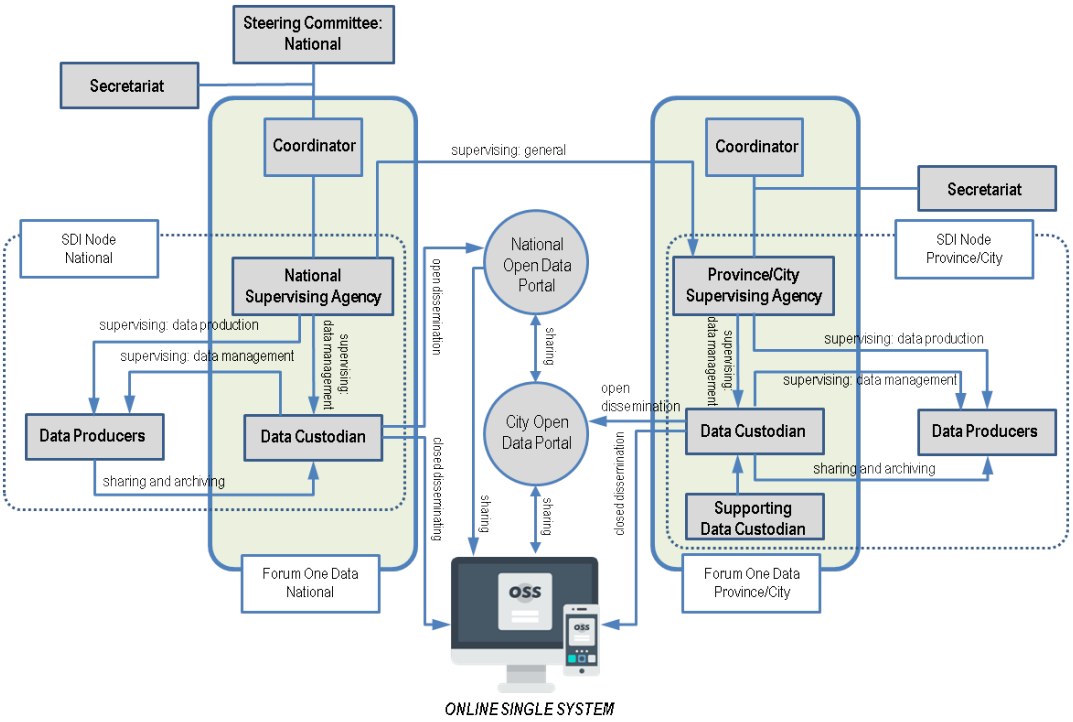


Figure 10. Spatial Data Infrastructure (SDI) nodes play vital roles in the OSS system under the One Data Indonesia (ODI) Regulation with left the national level, and right the provincial/city level.

In the digital era, information interoperability is vital for making land information understandable, meaningful, machine-readable, and machine-actionable. Interoperability is known as an integral part of reliable information infrastructure (Van Loenen & Grothe 2014; Kalantari et al. 2006; and Masser et al. 2008). In 2019, President Joko Widodo decreed the One Data Indonesia (ODI) policy to ensure availability, quality, integrity, accessibility data for planning, implementation, evaluation, and control of development[15]. Initially, ODI was aiming to provide data for supporting SDGs activities, but it also capable of facilitating the OSS for data access mentioned in EODB indicator sets. Under ODI, ministries, agencies, and local governments shall establish two roles: data producers and a single data custodian

[15] https://jdih.big.go.id/lihatdoc?id=32748324

(with supporting data custodian if necessary) within their organization. The governments also required by ODI to perform specific roles under this policy: Steering committee, Secretariats, Coordinators, and Supervising agencies; see Figure 10. This setting can be utilized to feed land information to the OSS systems. Local governments shall appoint The Local Development Planning Agency (Bappeda) as coordinator. Typically, the local office for communication, information, and statistics will be the supervising agency for statistical data and Bappeda for spatial data. The rest of the local offices and agencies shall perform data producers' role. Thus, OMP and ODI policies are fitted to be utilized in improving the availability and accessibility of RRRs information, linked with spatial representation, and share them via NSDI and the OSS to investors and landowners for doing business.

4 Prototype for 3D Registration and Visualization of RRRs: a case study

Implementation of Open data principles can reduce the information asymmetry that may be the cause of miscalculations and confusion among investors and landowners (Indrajit et al. 2019). The World Bank recommends the Building Information Model (BIM) standard to allow economic actors to submit construction design with more information (Molfetas & Wille 2018 and WorldBank 2014). The Open Geospatial Consortium (OGC) has initiated the integration of BIM and GIS since the mid-2000s (Cote 2007) and a year later for OpenGIS City Geography Markup Language (CityGML) Encoding Standard (Gröger et al. 2008). Geospatial communities, including academics, industries, and users, are familiar with these standards for data sharing. Finally, Góźdź et al. (2014) presented the possibilities of using CityGML for the representation of buildings (physical 3D objects) within the context of land administration (legal 3D objects), and Kutzner & Kolbe (2018) proposed the next version of CityGML (version 3.0) to contain LADM as CityGML improvement.

We developed 3D visualizations for RRR from the spatial planning plans in two Indonesian cities: Jakarta and Bandung (see Figures 10 and 11). We acquired spatial plan maps at scale 1:5000 from the city councils and transformed them according to the standardized data model prescribed in the proposed Spatial Planning Information Package. By implementing the proposed SP Package in LADM, the interoperability of the four aspects of land management can be implemented in LAS and the OSS system. Cesium® is useful in presenting and publishing 3D spatial plan. We extrude the 2D spatial plan into 3D (based on height and depth descriptions) and complemented with actual 3D buildings (CityGML) into the Batched 3D model (b3dm) tiling format by using FME® software to cover the whole City of Bandung and Jakarta. According to the Spatial Planning Act, zoning regulation is classified as public information.

Therefore, by having 3D spatial planning shared through NSDI (same data as used by the OSS system), all stakeholders can have better information for decision-making according to their intentions.

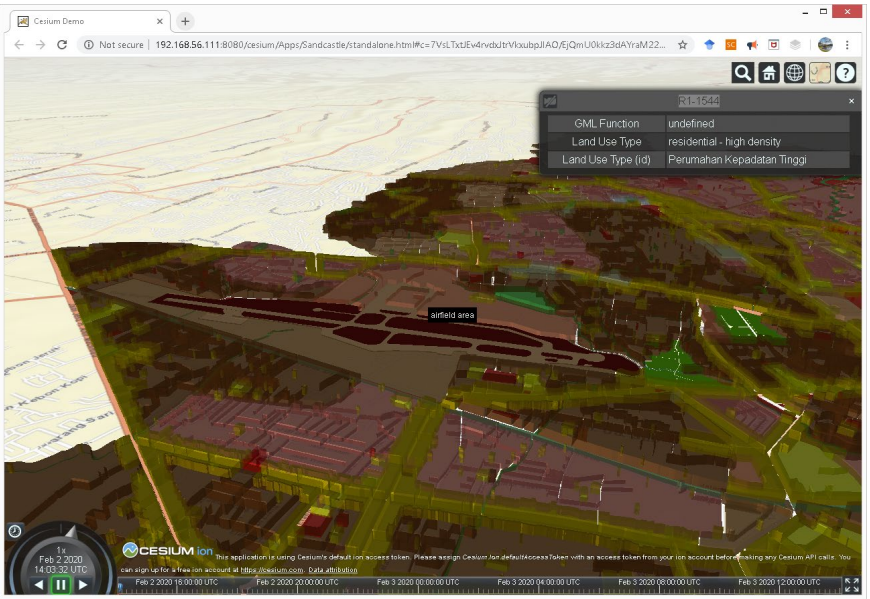


Figure 11. 3D representation of RRRs derived from the urban plan of Bandung, Indonesia. Visualization using the proposed Spatial Planning (SP) package of LADM revision and Cesium® (Location near to Husein Sastranegara International Airport).

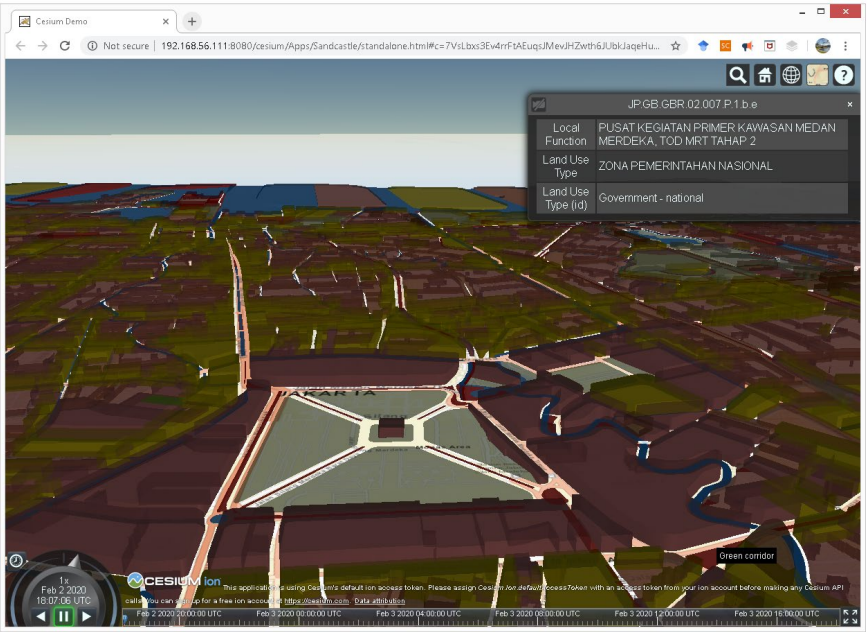


Figure 12. 3D representation of RRRs derived from the urban plan of Jakarta, Indonesia. Visualization using the proposed Spatial Planning (SP) package of LADM revision and Cesium® (Location near to Presidential Palace-National Monument).

5 Conclusion and future research

Research on how to create a better environment for improving doing business is intensifying in many countries. Indonesia attempts to create a stronger foundation of land information management to facilitate investors and landowners in registering land and dealing with construction permits. We recommend two critical areas for strengthening LAS to improve doing business indicator sets: in Subsection 5.1 standardization of land information (land tenure, land valuation, land use planning, and land development) and Subsection 5.2 sharing of land information through spatial data infrastructure (based on a new strategy for spatial data governance). In subsection 5.3, we reflect one more time on spatial planning and LADM. Finally, future work is covered in Subsection 5.4.

5.1 Formal standardization of RRRs information from land management

RRRs information can be sourced from land tenure, land valuation, land use planning, and land development. Authorities must have standardized information on RRRs. Furthermore, it is almost impossible for a digital and collaborative platform to work efficiently without information and technical interoperability. Three aspects of formal standardization are beneficial for improving doing business: 1. Complete range of RRRs (originating from the four functions of land management), 2. LADM Country profile agreed on and covering all relevant information, and 3. Code list values based on globally and multi-lingual definitions. These three aspects are now discussed in more detail below.

First, the integration of four functions of land management in LAS is a prerequisite in constructing a complete set of RRRs. Since land-use planning is already aggregating RRRs from multiple sectors (i.e., social, environment, economy), authorities must include them in LAS. The influence of spatial (urban) planning on property rights can be impactful by imposing restrictions (limitations) and responsibilities (obligations) on landowners and land users. Second, in order to improve the processes of registration of property (land) and the issue of construction permits, countries should develop LADM country profiles, using the LADM common conceptual model. Countries or cities may use the extensification of RRRs from Paasch et al. (2015) in the standardization for information sourced from public and private laws. The LADM country profile shall describe in classes of spatial representation (multidimensional), parties, administrative and sources, and RRRs sourced from functions of land management. These description classes are crucial to reach information interoperability for permit systems or issuing a land certificate. Third, in order to improve more users globally, the use of standardized code lists containing RRRs information in multiple languages will improve human understanding, but also adding machine-readability and machine-actionability. Therefore, the upcoming revision of the ISO 19152 on LADM will

be strategic for doing business if it contains four functions of land management: land tenure, land valuation, land use planning, and land development.

5.2 Sharing land information through spatial data infrastructure

Doing business in globalization and the digital era requires interoperability and a suitable environment for sharing data among economic actors around the world. Our study is in line with Van Oosterom et al. (2009) argument that land information is at the core of Global Spatial Data Infrastructure. Echoing to this argument, the United Nations for Global Geospatial Information Management (UN-GGIM) defined land information as Fundamental Geospatial Data Theme that countries should include in their Spatial Data Infrastructure (SDI) (UN 2018). Cadastre 2014, SDGs, and Doing Business are promoting the use/establishment of such infrastructure to allow open data sharing and society's involvement in accessing or contributing spatial information (Kaufmann & Steudler 1998; UN-Habitat 2017; and World Bank 2014). Our design presents how to acquire RRRs from data custodians and publish it among stakeholders not only to support registering property and issuing licenses, but also for decision-making in business activities. Information and technical interoperability to enable re-use of information by broader users as well as to allow economic actors to create value-added products from automation, such as providing services for economic calculations.

For Indonesia's case, ODI (One Data Indonesia) regulation is the foundation of national data governance. This regulation strengthens Indonesian SDI by enforcing stakeholders to participate within its systems as well as promoting standardizations and institutional arrangements in data sharing. However, Indonesia still has to develop guidelines and measurable indicators for continuous assessment. Indonesian SDI is a perfect match for supporting land information, as mentioned in EODB indicator sets. Besides LADM, the use of the CityGML framework is suitable for representing the actual buildings in city-wide applications such as business permits.

5.3 Spatial planning and revised LADM

While this paper exhibits that standardization will produce a standard and shared data model for better representing RRRs, it is primarily based on LADM improvements proposed during the revision process of this ISO standard. The existing LADM standard has already facilitated 3D geometry and temporal representation of RRRs but limited on land tenure (and land registration). Therefore, the upcoming revision of the ISO 19152 on LADM will be strategic for doing business if it contains four functions of land management: land tenure, land valuation, land use planning, and land development. From the practical views, to enable spatial information in supporting Doing Business, cities must consider

acquiring land information at map scale 1:5000 or better to have optimal representation and visualization of RRRs.

This paper presents examples of the implementation of the proposed Spatial Planning Information (SP) Package in two Indonesian cities: Jakarta and Bandung. Figures 11 and 12 highlight shows how the users (including citizens) can access the information according to the proposed Spatial Planning Package with associated RRRs by visualizing it in 3D. Under digital and collaborative platforms such as the Online Single Submission (OSS) system for requesting permits), perception of risk will be lessened if the system uses a standard conceptual data model that reduces problems arise from uncertainty and asymmetric information. The data provider (ministries and local governments) must manage and publish standardized information to enable users (business actors, landowners, and affected citizens) to understand land information, thereby allowing many economic actors to participate without fearing of uncertainty in registering property and dealing with construction permits.

5.4 Future research

At the time of this writing, President Joko Widodo is planning to submit the draft Cipta Kerja (Employment Creation) Act, an omnibus law, to parliament aiming at enhancing and strengthening the economic development and ease of doing business. This draft contains 11 clusters designated for improving doing business: Simplification of Licensing; Investment Requirements; Employment; Facilitating, Empowerment and Protection of Small and Medium Enterprise (SMEs); Ease of Doing Business; Research and Innovation Support; Government Administration; Sanctions; Land Procurement; Government Investment and Projects; and Economic Zones. The proposed Employment Creation Act includes strengthening of the OSS system and mechanism that can fasten land acquisition. However, this draft still preserves the location permit and Environmental Impact Analysis (EIA) only for high-risk economic activities and complex construction. If this draft becomes law, GOI will substitute the existing Permit-Based Approach (PBA) with a Risk-Based Approach (RBA). In the RBA, the OSS will categorize economic activities based on risk to health, safety, environment, and natural resource management. In this setting, permits will be compulsory for business activities with high risk, while medium risk must follow national standards. The risk-based approach is familiar among decision-makers in many fields of studies, particularly in economics, security, and disaster management (Pickett 2006 and Yohe & Leichenko 2010). For low-risk business activities, economic actors will only register into the OSS system. From the description above, we assume the RBA will contain prescriptive regulations that have a certain level of threshold value or condition to be attained. Therefore, the most likely option that for the economic actors as to how to achieve the threshold, and compliance can be directly assessed is by comparing whether

these actors refer to zoning plan or other regulations specified in the RRRs. Consequently, the OSS must use standardized RRRs information attached to each land or space.

More research aiming to standard the current spatial planning information is needed for developing permit or monitoring and evaluation systems. Countries can be benefited from research on integrating CityGML with BIM standards for data sharing between land developers and authorities. Researchers are encouraged to examine the proposed SP Package and develop the LADM country profile at the city level. Further research is needed to produce land information in a suitable resolution and share it in multidimensional representation through the SDI initiative.

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APPENDIX

Table 1: Type of Rights on Land Parcel/Space

No.	Type	Definition
1	Ownership Rights (*Eigendomrechts*) *	Rights of ownership are hereditary rights and are the strongest, and the fullest right one can have on land that may be possessed by an Indonesian citizen. This right may go over to and transferred to another party.
2	Exploitation Rights (*Erpachtrechts*) *	Rights to cultivate the land which is directly controlled by the State for a period of time. This right is typical in farming, plantations, fishing, or cattle-raising, which may go over and be transferred to another party. The validity of the exploitation rights is for periods of 25 or 35 years and can be further extended for another 25 years based on the formal assessment.
3	Building Rights *	Rights to construct and to own buildings on the land, which is not one's property for a period of not longer than 30 years. The right of the building, including its requirements of granting as well as its transfer and annulment of that right must be registered according to provisions.
4	Rights of Use *	Rights to use and collect the product from land is directly controlled by the State or land owned by other persons who give the privileges and obligations designated in the decision upon granting this right by the authority, or in the agreement to work the land,
5	Rights to lease *	Rights to lease land with lawful payment.
6	Rights of opening-up land of collecting forest product *	Rights opening-up land and of collecting forest products by Indonesian Citizens or Government Regulation.
7	Rights of using water, of breeding, and of catching fish.	Rights to obtain water for a specific purpose and to flow it over another person's land.
8	Rights of using air space *	Rights of using air space authorize the utilization of energy and elements in the air space to maintain the developing the fertility of the earth, water, and natural resources contained therein and other matters relating to it
9	Rights on land for religious and social purposes *	Rights of ownership on the land of religious and social institutions for social and religious purposes.
10	Pawn Rights	Rights of control and exploit land belonging to another person, who has received a mortgage until the mortgage is returned.
11	Rights of Profit-Sharing *	Rights of profit sharing on land owned by another person based on an agreement held between the owner and the cultivator from the concession on the land of the owner.
12	Rights of lodging (*Opstalrechts*) *	Rights to authorize a person establishing or occupying a building or land owned by another person based on trust and in the form of an unwritten agreement.
13	Strata title **	The ownership rights of an apartment unit, including joint ownership of public space in a building complex. The strata title concept separates rights from several strata or levels, namely the rights to the land surface, the earth below the ground, and the air above it.
14	Easement Rights ***	Rights are benefiting property or a piece of land that is enjoyed over another piece of land owned by somebody else.
15	Rights of way ***	Rights to pass along the way over property owned by another party.
16	Rights to propose ***	Rights to propose consideration in determining the direction of development;
17	Rights to clarify ***	Rights to identify the potentials and impacts from development, including rights to clarify access and benefiting from land, space, and spatial planning
18	Rights to object ***	Rights to spatial object plan and the implementation of the spatial plan

Table 2: Type of Restrictions on Land Parcel/Space

No.	Type	Definition
1	Building Boundary Line (*Garis Sempadan Bangunan*/GSB) ***	A line that limits the minimum clearances from the outermost side of a building mass to the boundary of the controlled land. The building boundary line is functioned as a space divider, or the minimum clearances from the outermost plane of a building mass to the land parcel, between the mass of another building or channel plan, electricity network, gas pipeline network, and so forth.
2	Building Floor Coefficient (*Koefisien Lantai Bangunan*/KLB) ***	The basic ratio criteria between the total floor area of the building and the area of land parcel allowed to be built.
3	Building Base Coefficient (*Koefisien Dasar Bangunan*/ KDB) ***	The percentage ratio between the total area of the ground floor of a building and the area of land parcel allowed to be built
4	Green Base Coefficient (*Koefisien Dasar Hijau*/ KDH) ***	The percentage ratio between the total area of open space outside the building intended for landscaping /greening and a land parcel by the spatial plan and building and neighborhood plans.
5	Basement Site Coefficient (*Koefisien Tapak Basement*/ KTB) ***	The percentage ratio between the basement site area and the plot land area/planning area that is controlled by the spatial plan and building and neighborhood plans.
6	Built-up Area Coefficient (*Koefisien Wilayah Terbangun*/KWT) ***	The percentage ratio between the area of built-up blocks (allotment) with the total unconstructed allotment within the planned area.
7	Building Density (*Kepadatan Bangunan*) ***	The percentage ratio between the area of built-up blocks (allotment) with the total planned area.
8	Zoning regulations ***	The provisions governing the use of space and control mechanisms for each zone by the detailed spatial plan.

Table 3: Type of Responsibilities on Land Parcel/Space

No.	Type	Definition
1	Protect the environment and ecosystem ****	To maintain the preservation of environmental functions and to prevent and overcome pollution and destruction.
2	Provide information about environmental management ****	To provide correct and accurate information regarding environmental management performed in specific land owned or controlled.
3	To utilize land parcel within schedule prescribed in the zoning regulation ***	To utilize or perform an activity on a land parcel or space according to zoning regulation
4	Compliance with permitting ***	To utilize or perform an activity on a land parcel or space according to permit.
5	Maintain and improve the quality of land or space ****	To perform a necessary activity in maintaining or improving the quality of land or space owned or controlled and public space.

*) Basic Agrarian Principle Law (1960); **) Apartment Law (1985); ***) Spatial Planning Law (2006); and
****) Environmental Management Law (1997)

Table 4: The proposed Class of SP_PlanningBlock (Indrajit et al. 2019)

Information	Description
pbID	The unique identifier of the planned land use unit
blockName	Name (or code) of a planned land use unit given by the authority
functionType	Type of Planned Land Use (e.g., housing, commerce, or farming)
protectedSite	Type of protection function, if any (e.g., archaeological, nature conservation)
naturalRiskSafetyArea	Type of protected site, if any (e.g., volcanic risk, inundation risk)
restrictionZone	Type of restriction, if any (e.g., dumping, mining, coastal management)
easement	Type of rights to use someone else's land for a specific purpose
constraintName	The label of constraint
constraintDescription	Description of constraint on a planned land use unit
geometry	Type of geometry for spatial planning

Table 5: The proposed Class of SP_PlanningUnit (Indrajit et al. 2019)

Information	Description
puID	The unique identifier of the Planning Unit
zoningName	The name (or code) of a planned zoning unit given by the authority
zoningType	Type of the Planned Zoning (e.g., apartment, trade or commercial offices);
status	Type of status of the planned zoning;
permit	Type of status of the planned zoning
volumeIndications	Indication of maximum allowable volume
surfaceIndications	Specifications about the maximum area of the zoning elements defined by a designated regulation (e.g., the built-up area vs. open space area)
heightIndications	Specifications about the limit of an object within the zoning elements that overlap the geometry of the regulation
unitIndications	Specifications about the limit of the amount of object within the zoning elements that overlap the geometry of the regulation
otherDimensionIndications	Specifications about dimensioning limit of the object within the zoning elements that overlap the geometry of the regulation
typeOfBuildingIndications	Specifications about the type of building within the zoning elements that overlap the geometry of the regulation
typeOfShapeIndications	Specifications about the type of shape of the object within the zoning elements that overlap the geometry of the regulation
otherConstructionIndications	Specifications about the type of construction allowed within the zoning elements that overlap the geometry of the regulation
referencePoint	Geodetic reference point - ISO 19107
geometry	Type of geometry for spatial planning
surfaceRelation	Type of location relative to the earth surface (i.e., below, on or above the surface)
area	Type of area values registered by the authority
volume	Type of volume values registered by the authority