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Implementation of Spatial Planning Package for Construction of an LADM Country Profile: Reducing Asymmetric Access to Information of RRRs in Indonesia

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Key words: Land Administration Domain Model, LADM Country Profile, Land Administration, Spatial Planning, Interoperability, Asymmetric Information, Spatial Information Infrastructure

SUMMARY

Spatial plan (or urban plan) as an aggregate product of sectoral policies (i.e., environmental, disaster management, economy, forestry), will be imposed to all land parcels in the form of public law to achieve the vision of a city. This vision relies heavily on the interoperability of land-use, land tenure, land value, and land development. The inseparability between land administration and spatial planning is widely acknowledged by cadaster communities in achieving sustainable development and important for landowners and investors alike. In July 2017, the government of the Republic of Indonesia established action plans for adopting, implementing, monitoring and reporting achievement of Sustainable Development Goals in both national and local levels. Spatial (or urban) planning is the key elements in these plans, particularly in fostering integrated urban and regional plans and supporting collaborative efforts towards well-coordinated national strategies. However, many of collaborative approaches are hindered by asymmetric information from lack of interoperability of information caused by the separation of management of land administration and spatial planning processes and information systems that sourced from silos of information. This phenomenon leads us to incomplete RRRs (Rights, Restrictions, and Responsibilities) information and causing hidden information for all responsible parties. The hidden information then creates high-cost economy, stimulates unnecessary disputes and instigates moral hazards. Asymmetric information condition, parties (authorities, landowners and prospectus buyers) are often being forced to put unnecessary efforts to investigate RRRs situations of their land parcels or properties against existing or revision of public laws within narrow windows of opportunity. This article aims to promote spatial planning information package in the upcoming ISO LADM revision to better integrate RRRs information from land administration and spatial planning into the existing Land Administration System. By exercising the spatial planning information package, a city can minimize asymmetric access to RRRs information among government institutions and between government and landowners or prospectus investors.

RINGKASAN

Rencana tata ruang kota sebagai produk agregat dari kebijakan sektoral (lingkungan hidup, manajemen bencana, ekonomi, kehutanan), akan dikenakan pada semua bidang tanah dalam bentuk hukum publik untuk mencapai visi kota. Visi ini sangat bergantung pada interoperabilitas informasi penggunaan lahan, kepemilikan lahan, nilai tanah, dan pengembangan lahan. Ketidakterpisahan antara administrasi pertanahan dan perencanaan tata ruang secara luas diakui oleh masyarakat pertanahan terutama dalam mencapai pembangunan berkelanjutan dan penting bagi pemilik tanah dan investor dalam pengambilan keputusan. Pada bulan Juli 2017, pemerintah Republik Indonesia menetapkan rencana aksi untuk mengadopsi, menerapkan, memantau dan melaporkan pencapaian Tujuan Pembangunan Berkelanjutan di tingkat nasional dan lokal. Perencanaan tata ruang (atau perkotaan) adalah elemen kunci dalam rencana ini, khususnya dalam mendorong rencana penataan ruang perkotaan yang terintegrasi dan mendukung upaya kolaboratif menuju strategi nasional yang terkoordinasi dengan baik. Namun, banyak pendekatan kolaboratif terhalang oleh informasi asimetris akibat dari kurangnya interoperabilitas informasi yang disebabkan oleh praktik pemisahan manajemen administrasi pertanahan dan proses perencanaan tata ruang dan pembangunan sistem informasi yang bersumber dari basisdata yang tidak terintegrasi. Fenomena ini membawa kita pada informasi RRRs (Hak, Batasan, dan Kewajiban) yang tidak lengkap dan dapat menimbulkan informasi yang tersembunyi untuk semua pihak yang berkepentingan. Informasi tersembunyi kemudian menciptakan ekonomi biaya tinggi, merangsang perselisihan yang tidak perlu dan memicu bahaya moral. Dalam kondisi informasi yang asimetris, para pihak (pihak berwenang, pemilik tanah dan pembeli prospektus) sering terpaksa untuk melakukan upaya yang tidak perlu untuk menyelidiki situasi RRR atas tanah atau properti mereka terhadap adanya atau revisi hak, batasan dan kewajiban atas undang-undang publik dalam waktu yang sempit. Artikel ini bertujuan untuk mempromosikan paket informasi perencanaan tata ruang dalam revisi ISO LADM yang akan datang yang mampu mengintegrasikan informasi RRR dengan lebih baik atas administrasi pertanahan dan perencanaan tata ruang ke dalam Sistem Administrasi Pertanahan yang ada. Dengan menggunakan paket informasi perencanaan tata ruang, sebuah kota dapat meminimalkan akses asimetris terhadap informasi RRR di antara lembaga-lembaga pemerintah dan antara pemerintah dan pemilik tanah atau investor.

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1. INTRODUCTION

Land Administration Systems (LAS) have been developed and improved from a spectrum of demands and theories adopted from laws, surveying, information and communication technologies, and social sciences (Lemmen 2010). As land-related information and information sharing gaining importance in achieving Sustainable Development Goals (SDGs), interoperability between land administration and spatial planning plays a critical role in land management, especially in cities. According to the United Nations (UN) (2014), urban areas will host 60% of the world's population in 2030 and will continue to grow to almost 70% in 2050. These numbers suggest that cities will determine the success of SDGs shortly (Corbett & Mellouli 2017). With the increase of pressure mounted on urban areas, land-related information will play a decisive role for a city to achieve indicators determined in SDGs. Although these indicators are not legally binding, the UN's 2030 Agenda encourages member countries to develop or improve their planning instruments by accommodating measures to achieve SDGs for national and local development strategies (UN 2015). LAS contains vital information for stakeholders to fulfill indicators of SDGs, particularly in ensuring equal rights to all citizens of access to economic resources, providing public services, ownership, and control over land and property, and natural resources. On the other hand, spatial planning system manages information on restriction and responsibilities over land from multi-sectors mentioned explicitly in SDGs, namely agriculture, forestry, social, environment, energy, marine, urban management, disaster management, and so forth. All stakeholders shall have access to this information for planning, executing, monitoring, evaluating, and reporting efforts in achieving SDGs through an online platform in facilitating member states in sharing knowledge, experiences, best practices and enhancing synergies (UN 2018). If this initiative can be fully operational, it can construct a foundation for reducing asymmetric access to information in cities by sharing public information, including land administration and spatial planning among government institutions and to its citizens alike. For example, a city can publish this information in the form of Application Programming Interfaces (APIs) as ready-made that are available for citizens or repackaged as services to the third party. Although many cities share both land administration and spatial planning information through web applications, we could not find a case that these systems include information about Rights, Restrictions, and Responsibilities (RRRs). Jetzek et al. (2014) noted that asymmetric information between governments, businesses, and citizens is the reason for an uneven distribution of prosperity.

Further, they suggest that transparency can reduce uncertainty from asymmetric information, as well as increase accountability. In 2012, the International Standards Organization (ISO) published ISO 19152:2012 on The Land Administration Domain Model (LADM) (ISO 2012). This standard aims to provide an extensible foundation for efficient and effective LAS, to provide interoperability through ontology, and to facilitate information sharing between responsible institutions and stakeholders (Lemmen & van Oosterom 2011). By implementing this standard, the authority having the responsibility in land administration in national or local jurisdiction can ensure interoperability of its LAS with spatial planning information system. This article proposes a case that LADM should also be applied for managing public laws and their spatial representation by other public institutions relating to the land to enable data integration and dissemination in minimizing asymmetric information among stakeholders in land administration. The government of the Republic of Indonesia declared the adoption of SDGs into the national development and will implement the Agenda 2030. In July 2017 a government regulation on Implementation on the achievement of SDGs was enacted. This regulation commands action plans for adopting, implementing, monitoring, and reporting achievement of SDGs in both national and local developments (GOI 2017). This article aim is to give the reader a different perspective of the potential of LADM in reducing asymmetric information and its significance to spatial planning and land administration. We will discuss the asymmetric information and its applications on integrating information about RRRs based on ISO 19152:2012 (LADM). We determine three research questions for this article as follows:

- First, we present a literature study and proper explanations on asymmetric information, LADM, RRRs derived from Spatial Planning and to study its implications. These sections include presenting the fundamental concepts and also finding out how to integrate RRRs from spatial planning and land administration.
- Secondly, we intend to find out how to implement the proposed spatial planning information package of LADM in minimizing information asymmetry. We also present how to implement this package in Indonesia.
- Lastly, we will try to improve the LADM country profile of these countries with applications where current information infrastructure could be utilized in improving the completeness of RRRs information.

2. ASYMMETRIC INFORMATION IN RIGHTS RESPONSIBILITIES AND RESTRICTIONS OF LAND PARCEL

Impact of information derived from public law to the property rights can be decisive for existing landowners. Absent of this information in official land registers and land certificate, disclosure of information and lousy policymaking will decrease the quality of the decision made by landowners, as well as businesses and authorities. City governments in developing countries must develop a mechanism to monitor and enforce spatial planning regulation. Asymmetric information may lead to business disruption (see Figure 1) or damage landowners' investment (Figure 2). However, these situations are common since countries

manage land tenure rights and land use rights in a separate mechanism or authorities than spatial planning (Enemark 2004). Kaufmann & Steudler (1998) warned that in some extents, traditional cadastre systems might cause asymmetric information. This condition may force landowners to put continuous efforts to investigate the legal situation of their land against newly enacted or revision of public laws within its narrow windows of opportunity. Further, similar to the interested parties or investors, they must put some resources to gather the legal status of a land parcel to avoid loss due to RRRs imposed by private law and public laws, particularly by spatial planning regulations.

Figure 1. The Bandung City Government sealed Hotel de Java on Jalan Sukajadi, Bandung, which was considered to violate height criteria in the Building Permit (https://jabar.tribunnews.com/2019/02/28/pemkot-bandung-segel-hotel-de-java-di-jalan-sukajadi-harusnya-4-lantai-malah-bikin-6-lantai)

Figure 2. Jakarta City Government forcibly demolished the five-story building in East Jakarta due to land use violation and permit (http://poskotanews.com/2015/08/12/bangunan-hotel-lima-lantai-dibongkar/)

Asymmetric information arises when these parties perform their decision based on different information. The concept of asymmetric information theory was founded in the 1970s by George Akerlof, Michael Spence, and Joseph Stiglitz to explain common phenomena in a transaction (Auronen 2003). This paper considers this theory only in three aspects: adverse selection, signaling, and screening. Adverse selection refers to a situation in which some parties have more information than other parties about some aspect of commodity or product (Akerlof 1970). In land management perspective, an adverse selection often happens when parties hold some information to other parties (i.e., buyers, landowners), mainly information about RRRs that can incur hidden costs or prevent benefits in the future. This condition may cause market failures which any society should avoid (Stiglitz 2000). The government can also be considered as a party when creating or updating RRRs of a land parcel in land management activities (Enemark 2004). Spence (1973) proposes the signaling concept where a credible party conveys some information about the product to other parties. A country ca assign their government to prevent land market failure caused by asymmetric information, mainly through "signaling" land-related information and regulations to all stakeholders (Algemene Rekenkamer 2015). On the other hand, Screening refers to an activity (and ability) of a party in accessing, filtering and reusing the accurate information of specific product being released into the market. Interoperability is the key element of a spatially enabled society (Steudler & Rajabifard 2012). LADM provides standardized data modeling in supporting interoperability of land-related information. A situation that represents adverse selection in which landowners (O) and buyers (B) have to screen information of RRRs (blue arrow lines in Figure 3.a) from local governments (G) and land agency (L) (see Figure 3.a).

In January 2013, G-8 announced "Lough Erne Declaration" to promote accessibility of land-related information and universal land and property rights for achieving sustainable (economic) growth and reducing poverty with respecting the property rights of local communities (Cameron 2013). This declaration encourages countries to provide "signals" by sharing RRRs information (red arrows in Figure 3.b), to facilitate buyers/investors in accessing and evaluating (screening) available information to make decisions on acquiring a land parcel, and to encourage countries publishing necessary information to the citizens. Such enablement can be performed by providing an intermediary (I) (in the form of institutions or mechanism) that facilitates information sharing among stakeholders (Figure 3.b). LADM play an essential role in the digital economy by ensuring interoperability and providing semantic of land-related information in an open and distributed environment. Kerber & Schweitzer (2017) consider interoperability as the ability of a system, product, or service to communicate and function with another system, product, or services. Most of the transactions in the digital economy require a certain level of interoperability and an open infrastructure for enabling parties to avoid uncertainties and unnecessary risks caused by asymmetric information (Dini et al. 2008). An information infrastructure, such as Spatial Information Infrastructure (SII) constructs a supportive environment in facilitating stakeholders to share and re-use their information (van Loenen et al. 2006). Ferraro (2008) provides a classification of asymmetric information between land stakeholders into two classes: hidden information and hidden actions. Hidden information happens during contract negotiation, whereas one or more parties

involved in the transaction have incomplete information about the cost or opportunity cost. In this case, landowners must either pay additional costs or lose all or part of the opportunity to gain the benefit of their land. Unlike hidden information, hidden actions may occur when one or more parties in a land transaction are unwilling to fulfill contractual or legal responsibilities. This article focuses on using LADM in reducing asymmetric information among stakeholders in land ownership (authorities, buyers, and owners concerning spatial planning regulations. Schmitz (2006) highlight a plausible assumption for asymmetric information happens in the property market when a party to have more information. Different data model are often applied in land-related information by many institutions to meet each institution demands. Variety in data models caused information asymmetry among government institutions and affecting property markets (Tambuwala 2012).

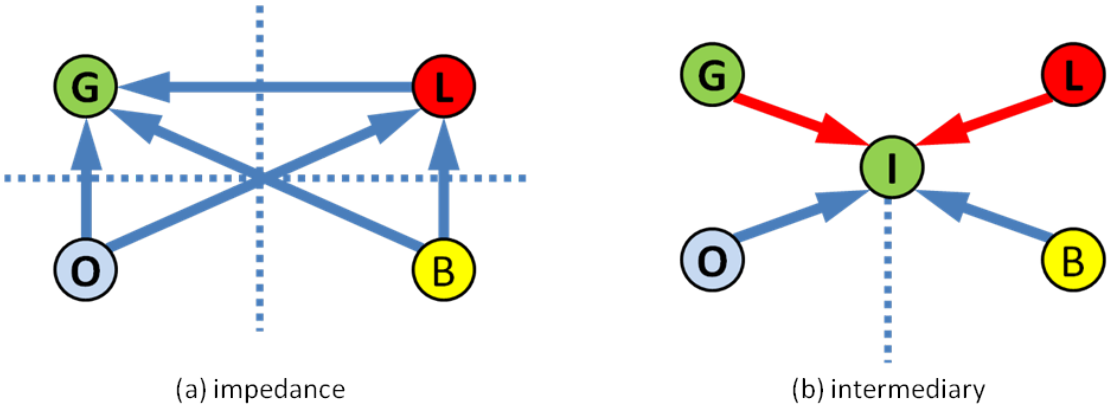


Figure 3: Type of disconnected flows of RRRs information sourced from spatial planning and land administration regarding asymmetric information caused by adverse selection (dashed blue lines). LADM can be used in nodes or intermediary (b) Blue arrow lines represent screening and Red arrow lines stand for signaling of RRRs information among local government (G), land office (L), landowner (O) and prospective buyer/investor (B) and the existence of intermediary mechanism (I).

3. METHODOLOGY: RRRS FROM SPATIAL PLANNING

SDGs prescribe indicators to ensure social, economic, and environmental aspects in policy-making for all ranges of development, including in land management. Experts in land administration have recognized the inseparability between land administration and spatial planning in achieving sustainable development. This vision relies on the interoperability and integration of land-use control system with land tenure, land value, and land development systems. Enemark (2001) noted that these four components of land management are interrelated and interdependent in constructing the foundation of sustainable development. Since the early 2000s, spatial planning is being used as a tool for integrating policies in Europe and around the world (Van Straalen 2012). However, in its strategic plan 2020-2025, UN-Habitat (2018) the integrative process of spatial (urban) planning in making a smart and sustainable city by reconciling the competing interest in determining the city form and

functionality, servicing of the public good and representing the collective values. In practice, planners implement a holistic approach to integrate ranges of interlinked sectors, strategies, and policies on social, economic, and environmental to achieve development goals (Biesbroek et al. 2009). Antrop & Van Eetvelde (2000) defines holistic as an approach that considers the whole is better than the aggregation of composing elements and promoting the importance of the relationship between these elements. Vigars (2009) noted that such integration of policies from different sectors in spatial planning is compulsory. Nadin (2007) differentiate traditional land use planning and spatial planning. Each of the land unit determined by urban planning will have specific information about rights, restrictions, and responsibilities (RRRs) (see Figure 4). Failure to develop interoperability in integrating spatial planning with the rest of land management components will create asymmetric information for government institutions, as well as for the rest of societies.

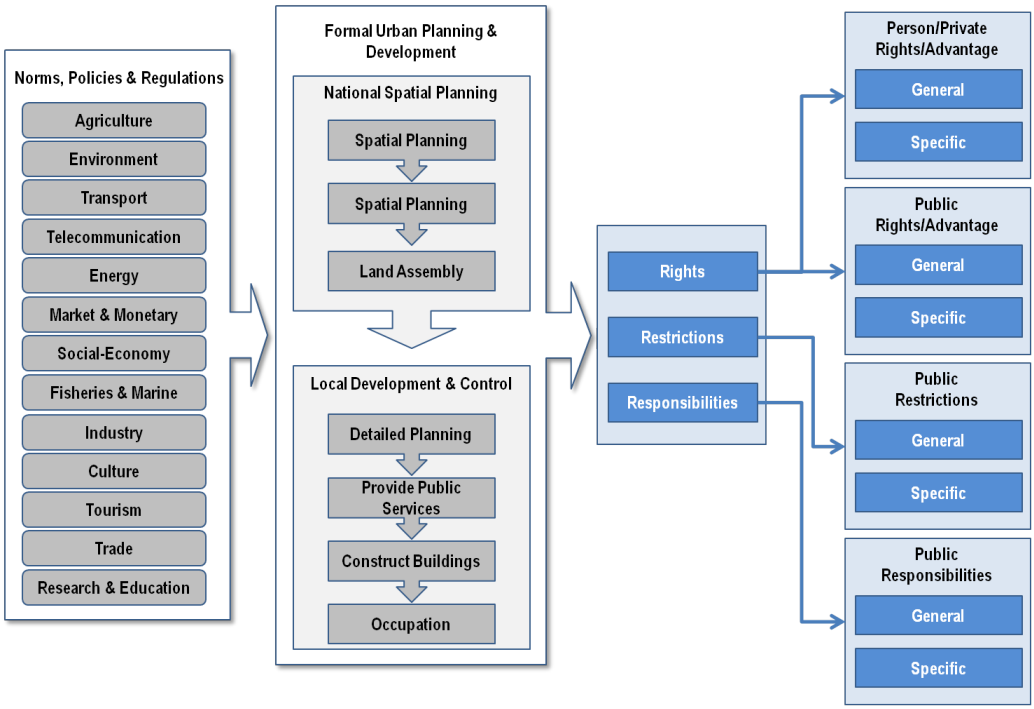


Figure 4. RRR derived from Holistic Spatial Planning Processes using LADM. (Adapted from Sliuzas et al. 2010, and Paasch 2012)

FIG (1995) has long acknowledged the importance of spatial plans in the cadastre activities, particularly in identifying spatial representation and registration. Van der Molen (2015) considers that spatial planning influence property rights by imposing land use policy limiting or expanding the ownership rights. The concept of the land right must be in harmony with social and environmental restrictions and responsibilities (Figure 4). Jacob (1993) noted that spatial planning is often utilized as an ideal mechanism to manage the supply of land for ranges of interests. In this mechanism, the spatial plan (or zoning plan) populates and accommodates every aspect that influences physical development and land. In this setting, the most detailed spatial plan is the local plan (zoning plan) which prescribes RRRs and criteria

for each zoning type. Many pieces of literature report the practice of performing sectoral policies integration at the regional and local level (Healey 2006 and Schmidt-Thomé et al. 2005). Therefore, it is essential to have proper documentation of RRRs and transparency of land-related information to responsible parties that can translate a conceptual model into concrete LAS capability to support SDGs into reality. In most cases, the spatial plan and zoning plan are strengthened with legal documents and must be used as a reference by related government institutions, business, and citizens. Improvement is needed in developing an effective way to relate and ensuring interoperability of information of land tenure with spatial planning policies and vice versa.

Paasch (2012) introduces the classification of RRR from public laws based on ownership rights, public advantage, and public restriction. He considers temporal aspects in this classification and consolidates restrictions (prohibitions) and responsibilities (obligations) into public restrictions class. Prohibitions in this classification refer to the limitation of performing specific activities on land/property while obligations represent mandatory actions to be executed by landowners (Figure 4). He further extends the RRRs classes into general and specific subclasses to differentiate specifications. In some cases, public laws granted an advantage (permission/rights/dispensation) to a landowner in conducting certain activities on a land parcel (Paasch 2012). In 1998, FIG launched Cadastre 2014 initiative in responding to the trends in development. This initiative consists of six statements that attempt to put into reality the vision for future cadastral systems. Cadastre 2014 encourages countries to have complete legal aspects (including public rights and restriction) and linked them with their spatial representation (Kaufmann & Steudler 1998). Therefore, a proper data model is needed to pave ways for information integration between land administration and spatial planning. Cadastre 2014 and SDGs also promote transparency and citizen's enablement in accessing and utilizing land-related information (Williamson 2014 and UN 2015). Cadastre 2014 prescribes the future cadastre systems capability in documenting complete, accurate, and reliable land-related information for the basis of decision-making, including for the landowners. If both land administration and spatial planning are interoperable and accessible to the relevant parties in near or even real-time, this will offer valuable advantages in these two worlds for a better-informed decision- and policy-making. Van Oosterom et al. (2009) and Enemark et al. (2004) highlight the importance of land administration for SII role in administering rights, restrictions, and responsibilities to support sustainable development. Land registries, land use maps (existing and future land use), land values, and land development map are the core information to this function and will be vital to the economy, social, and environment. This article utilizes the qualitative approach advocated by Maxwell (2008) and simplified information flow lifecycle proposed by Tambuwala et al. (2012) to evaluate the proposed Spatial Planning Information Package in minimizing asymmetric information in multi-purpose land administration and spatial planning information system. This article focuses on supporting the vision of Cadastre 2014 by providing complete information on the legal situation (RRRs) of land from spatial planning processes and defining its information structures and data models.

4. LADM: MANAGING 3D INFORMATION OF RIGHTS, RESTRICTIONS, AND RESPONSIBILITIES

The early concept of the relationship between land and public interest was mentioned by Samuelson (1954) in "The Pure Theory of Public Expenditure." He suggests that the foundation of the public arbitration to the land rights is the concept of "public good" where land parcels or spaces as public goods are to be available for everyone and without competition. FAO (2012) noted that there are many interests over land parcel in the form of RRRs among people as individuals or groups (FAO 2012). These interests are bounded to three-dimensional spaces and temporal dimension. Ekbäck (2009) suggests that public interest in the form of restrictions and responsibilities can influence land or property ownership (and land value) as regulations construct prohibition and obligation as well as an advantage for the landowner. UN-Habitat (2018) acknowledges the important linkage between land management and spatial plans for sustainable development. Thus, preserving and integrating information of land tenure with spatial plans and multi-sector policies is essential for local governments in obtaining diversified and sustainable revenues, allocating public investment, and providing essential services and infrastructure, as well as for communities for supporting decision-making and improving their living standard.

Land-related information is created by many stakeholders from various organizations and by producers with different skill and devices. This data has to be processed and validated before being consumed as for providing legal security or decision-making. The ISO 19152 of Land Administration Data Model guides the consistent development of LAS, particularly in aggregating Rights, Restrictions and Responsibilities (RRR) from land administration and spatial planning. ISO 19152:2012 (LADM) provides a conceptual model for documenting land information in a formal language (Lemmen 2012). This standard offers a reference model to ensure interoperability in describing the relationship between people, land, and through RRRs (ISO 2012). The LADM is vital for facilitating information sharing in cross-organizational, cross-jurisdictions, and distributed environments (i.e., Spatial Data Infrastructure or Geospatial Information Infrastructure) by providing shared ontology and consistent terminology of the land administration for legal administrative aspects, geometry, temporal, observation and measurements, and metadata. Therefore, information on RRRs shall represent existing regulations, policies, and cultures. Van Oosterom & Lemmen (2015) highlight the important of the quality of RRRs information including clarity, completeness, reliability, timeliness, and consistency. Further, they indicate that there will be demand for information sharing and linkages through Spatial Information Infrastructure (SII) between domains (i.e., spatial planning) at all level of jurisdictions. LADM prescribes a right as "activity or class of actions that system participant may perform on or using an associated resource." This standard also defines restriction as "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 of a land parcel in class LA_BAUnit and three subclasses: LA_Right, LA_Restriction, and LA_Responsibility (Figure 5).

The basic administrative unit (LA_BAUnit) represents zero or more parcels that associate with one or more homogeneous RRRs (Lemmen et al. 2015). The current version of LADM is already capable in describing the relationship between people (LA_Party), land (LA_SpatialUnit) and RRRs (LA_RRR) in three dimensional (3D) representation or even in 4D with temporal aspect without gaps and overlaps (see LA_BoundaryFace and VersionedObject in Figure 5). However, there is room to be explored for improvement, particularly in integrating land management components (i.e., land tenure, land value, land use, and land development) into RRRs classes. In 2015, Paasch et al. (2015) proposed the extended abstraction of RRRs according to the type of interest on land in European countries (the Netherlands, Germany, Portugal, and Sweden), namely privately agreed interests and legally binding restriction from government institutions for the public interests. The extended abstraction contains private interest in LA_PrivateRight, LA_PrivateRestriction, and LA_PrivateResponsibilities; and public interests in LA_PublicRight, LA_PublicRestriction, and LA_PublicResponsibilities (see Figure 5).

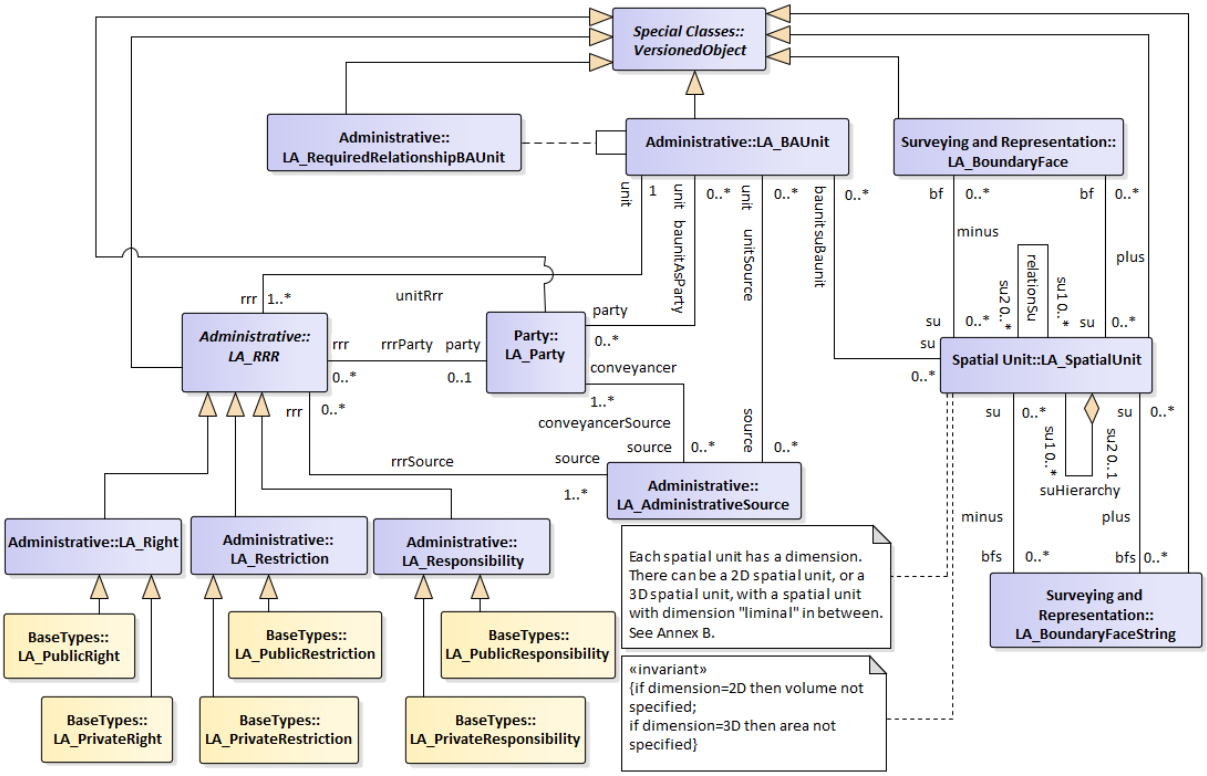


Figure 5. LADM Administrative Package with relation to Party and Spatial Unit of a land parcel (Blue) and classes representing extended RRRs (Yellow) (ISO 19152:2012 and Paasch et al. 2015)

The spatial planning information package is currently under review in LADM revision. The package aims to improve the completeness of RRRs and to provide a spatial representation of restrictions and responsibilities and to improve the linkage between land tenure with land use and land development plans. For this reason, we present the proposed Spatial Planning Information Package that contains RRRs derived from spatial planning processes (see Figure

6). This package aims to integrate sectoral policies and public laws aggregated in the spatial planning process into the LAS. Further, this package attempts to support stakeholders in performing decision- and policy-making with complete information about legal situations with their spatial representation. Several initiatives are organized in harmonizing spatial planning information, namely Plan4ALL project and INSPIRE. Both initiatives highlight the differentiation of existing land use with planned land use. Plan4All data model proposes two classes in the data model: "PlanObject" and "PlanFeature" while INSPIRE assigns "SpatialPlan" to represent spatial plan and ZoningElement for the detailed urban plan (Murgante 2011 and INSPIRE 2014). PlanObject represents spatial plan, while PlanFeature contains land use indication of a specific area. Čerba (2010) highlights the relationship between INSPIRE data model and Plan4All data model, particularly on the status of land use indications, type of regulations, and spatial planning referencing. In 2012, INSPIRE published guidelines containing spatial data model, Generic Conceptual Models, including spatial data models in Annex I, II, and III (Tóth et al. 2012). This paper presents a showcase in using these progress to relate RRR information from spatial planning onto the land parcel.

A spatial plan prescribes restrictions and responsibilities in the form of a function of land to parties by public laws determined by authorities in the form of spatial information. In reality, the spatial plan might not share the same boundary with land administration (see Figure 7). Moreover, in a complex urban setting, a land parcel may contain two or more spatial plan classes. In this setting, a land parcel may not be the smallest unit (atomic) on which sectoral policies or integration might have governed, such as building code or apartment. This situation can be resolved with the use of LA_SpatialUnit, an LADM class representing an object within a land parcel. Spatial representation of these classes can be in 2D or 3D. Moreover, LADM also provides LA_BoundaryFace class to represent land parcel as 2D surface or 3D space and VersionedObject to manage temporal changes and to create a 4D representation of RRRs. The proposed spatial planning information package contains three main classes: SP_PlanningBlock, SP_PlanningGroup; and SP_PlanningUnit (Figure 6). SP_PlanningBlock represents spatial planning, while SP_PlanningUnit depicts a zoning plan or a detailed plan. Both classes contain geometry information and prescribe legal expression constructed in spatial planning processes. 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 include supplementary regulations containing legally-binding documents.

By re-using LADM classes, spatial planning information package can provide the 3D and 4D (3D and Time Aspect) representation and combination of RRRs information from land tenure and spatial planning, as well as (see VersionedObject and RRRs classes in Figure 6). By having a complete overview of RRRs in a single data model, the OSS can serve the government, businesses, and landowners for its capability in ensuring interoperability, managing documents sources, and providing spatial representations. The high density and complexity in an urban setting require the multidimensional representation of RRRs from land administration and spatial planning perspectives in urban space. Indonesian regulations acknowledge these needs, particularly in providing public services and land (and space)

management (see Figure 5). In practice, some criteria are best represented in 3D for decision making, preventing accident, conflict, disputes, and fraud, particularly in cities.

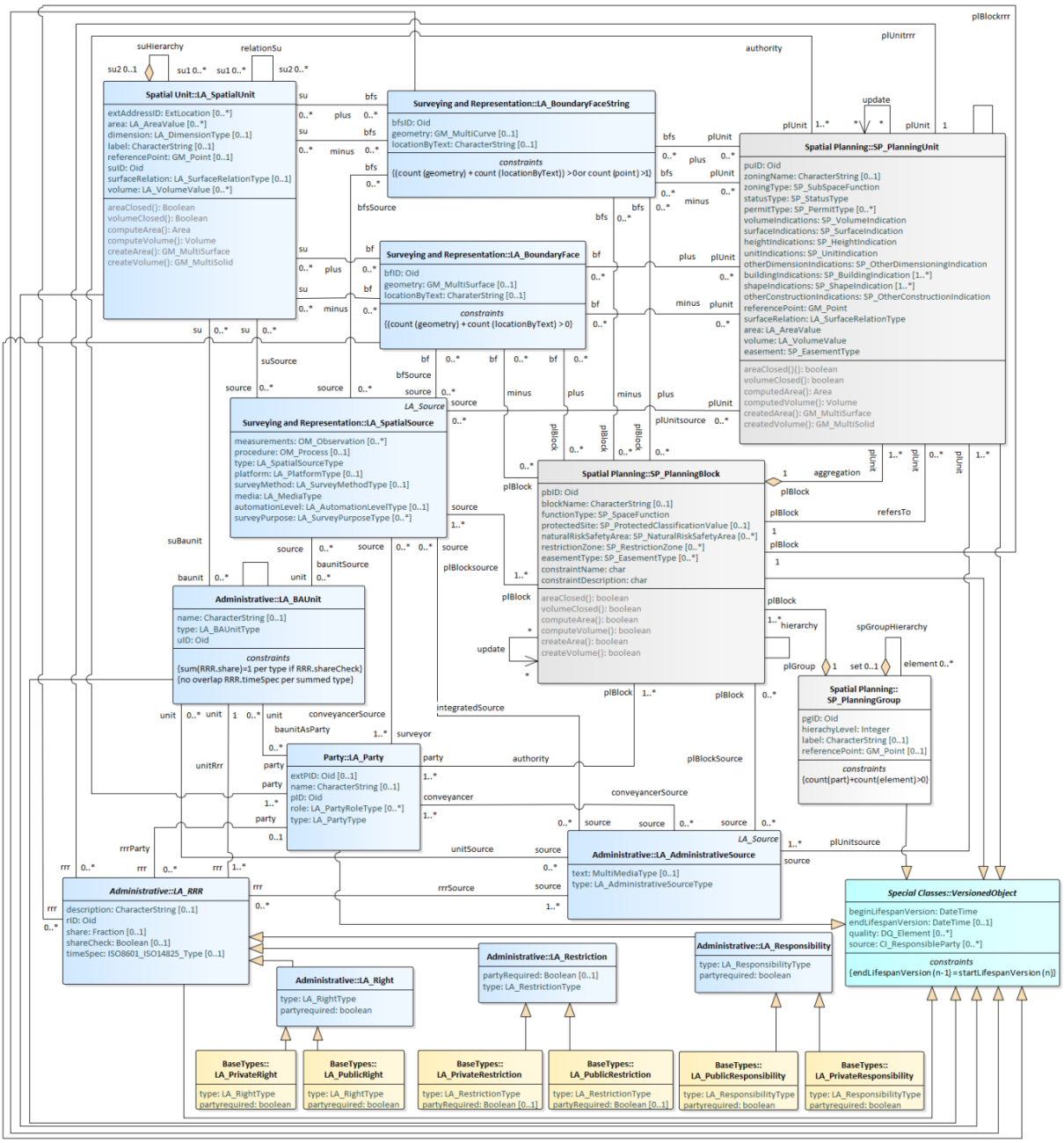
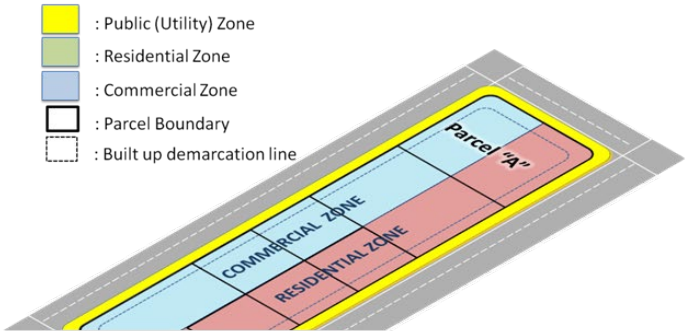
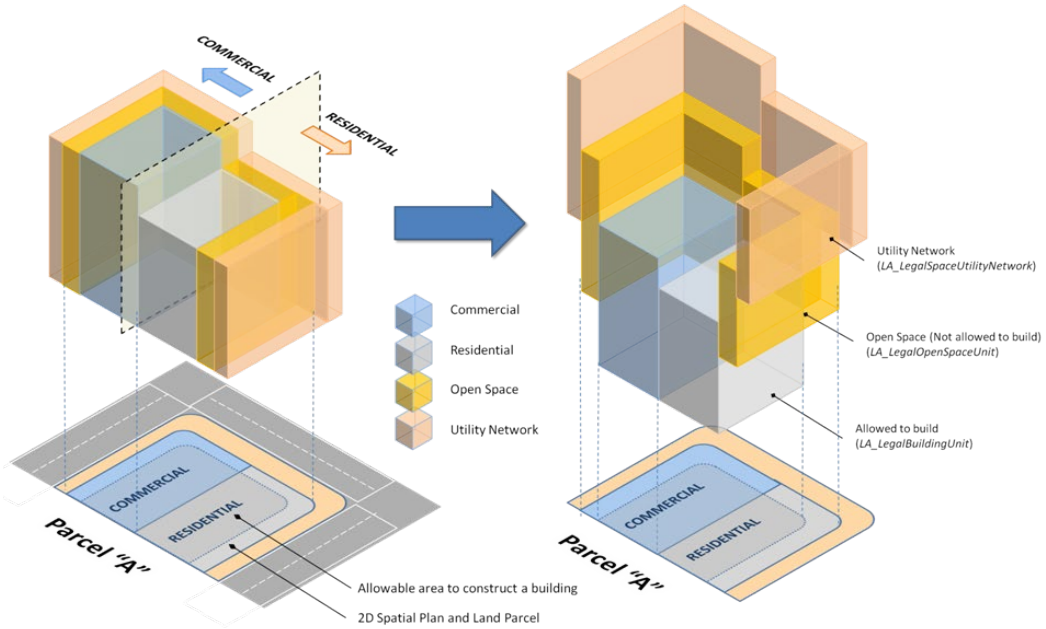


Figure 6. LADM Spatial Planning Information Package (Proposed) (Grey) with relation to RRR, Party and Spatial Unit of a land parcel (Blue) and classes representing extended RRRs (Yellow) from Spatial Planning Processes (Adapted and modified from ISO 19152:2012 and Paasch et al. 2015)



a. Typical Zoning Regulation in an Indonesian city block



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

Figure 7. Spatial Planning Information in a LA_BAUnit

5. IMPROVING COUNTRY PROFILE WITH SPATIAL PLANNING INFORMATION PACKAGE: INDONESIA

The Indonesian constitution acknowledges the importance of land use and land ownership to many aspects of life and affirms that the state must protect the interest of the citizens and manage land, water and natural resources contained therein for maximum use for the prosperity of its people. Although Indonesian laws recognize private ownership, in principle, land, water, and natural resource are owned by the State. The utilization of these resources must be regulated and developed in well-coordinated spatial zoning to achieve people's prosperity as well as to avoid social conflicts and environmental degradation. Thus, spatial planning must accommodate cross-sectors policies concerning local culture and characteristics. Spatial planning and land administration aim to ensure people having access to

the process of constructing and utilization of land and space, particularly in using land or space for business. The State may grant a privilege to parties in utilizing land or space concerning existing laws. Therefore, it is inevitable for government institutions to have information infrastructure and interoperability in managing information of right, restrictions, and responsibilities (RRRs) to provide, monitor, and control the use of land and space.

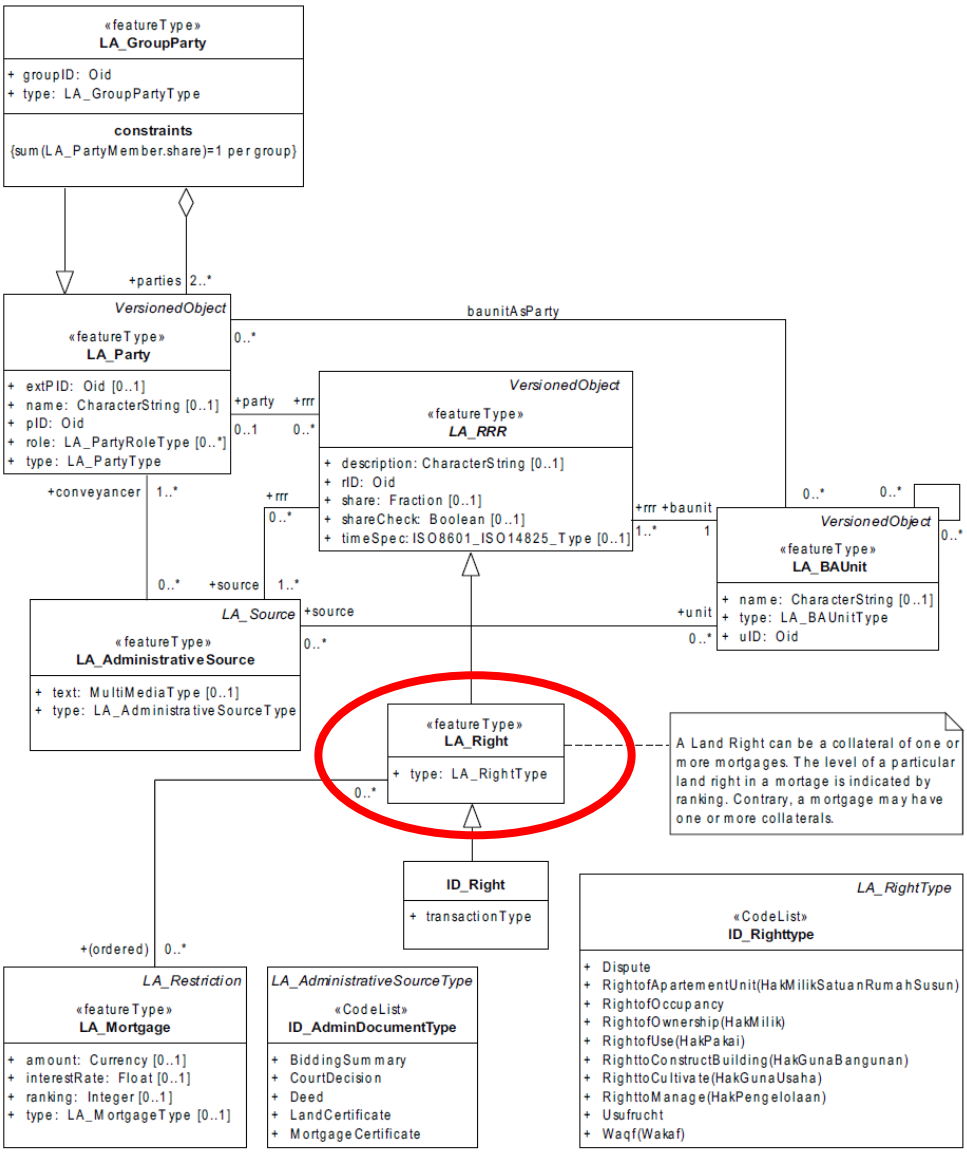


Figure 8. Indonesia LADM Country Profile (ISO 19152:2012)

The legal foundation of land administration in Indonesia is the Basic Agrarian Principles Law (1960). This law prescribes land administration (and registration) towards legal certainty (rechtskadaster) over land ownership by introducing three elements: cadastral mapping, legal documentation, and land registration. Following the Basic Agrarian Principles Law, there were several regulations enacted in governing land administration, namely authorization of National Land Agency (Badan Pertanahan Nasional/BPN) to develop and maintain its National Land Information System (NLIS). Pinuji (2016) reported that the development of LAS in Indonesia started in 1997 and being improved with Land Office Computerization (Komputerisasi Kantor Pertanahan/KKP). Further, he highlights that continuous development and improvement of NLIS by BPN with focus on minimizing manual work and enabling linkage between spatial with textual information. The current version of NLIS is Geo-KKP which provides effective and efficient data management based on ISO 19152:2012 (LADM), including detection and reduction of redundancies, utilization of single reference system, standardization, and information sharing. The early version of the LADM country profile for Indonesia is also presented in Annex ISO 19152:2012 (see Figure 8). Geo-KKP is a distributed application that manages the whole spatial dataset from 34 provincial offices and 458 cities/municipal offices (Ministry of Cadastre and Spatial Planning 2016). Office of Presidential Staffs (Kantor Staf Presiden/KSP) reported that BPN had been successfully documenting and registering 51 million from approximately 150 million land parcels in Indonesia.

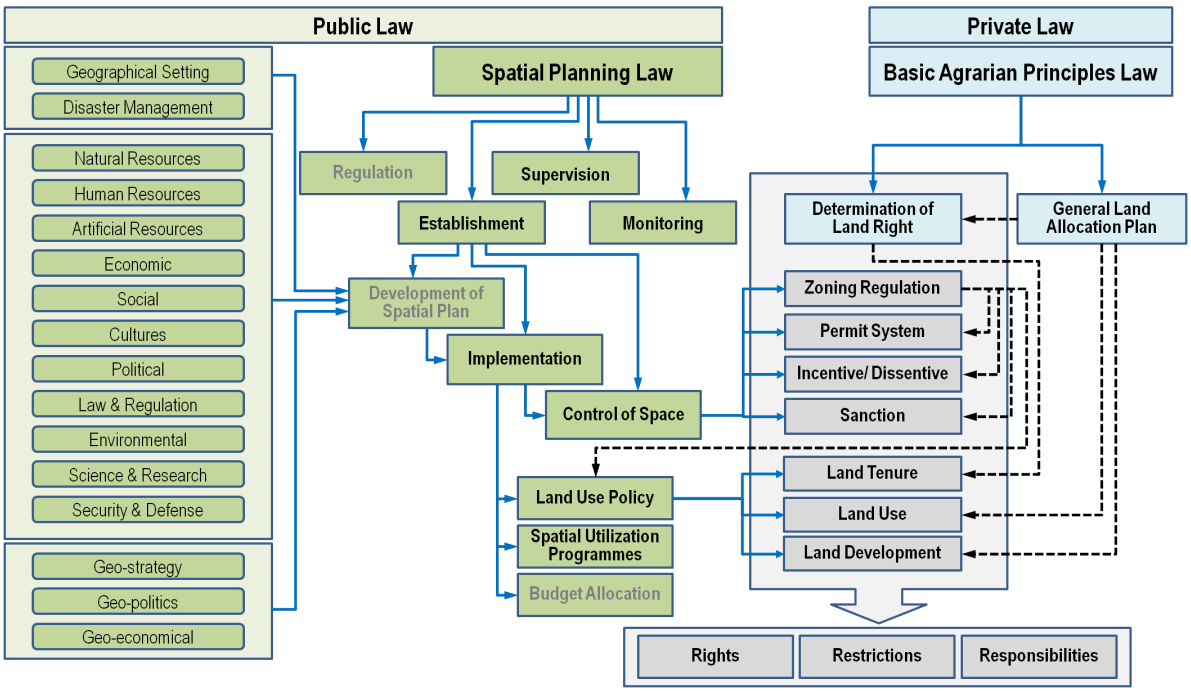


Figure 9. Relationship between Indonesian Spatial Planning Law and Basic Agrarian Principles Law. Blue lines represent elements and Dashed Black Lines represent referencing. The Grey boxes are maintained in ministries and local governments. The Blue boxes are activities conducted by the Office of National Land Agency (BPN). Green boxes represent overlaps activities from collaborative actions by these stakeholders.

Table 1: Type of Rights on Land Parcel/Space

No.	Type	Definition
1	Ownership Rights (*Eigendomrechts*) *	Rights of ownership are hereditary right and are the strongest and 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, 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 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 purpose.
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 on 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, river or beach boundary, between the mass of another building or channel plan, high voltage 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 mechanism 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)

In President Joko Widodo administration, BPN and Directorate General of Spatial Planning were merged into the Ministry of Agrarian (Land Administration) and Spatial Planning. This ministry is responsible for policymaking, coordination, and implementation of land administration and spatial planning. However, as regulated in Spatial Planning Law (2007), Indonesia applies hierarchy in spatial planning which central government has to collaborate with local governments (provincial and city levels) in developing, implementing, monitoring, and evaluating spatial planning. Each of this level has its spatial planning (i.e., national spatial plan, provincial spatial plan, and city/municipal spatial plan) of which the lower spatial plan must refer to the upper spatial plan. In consequence, the most comprehensive spatial plan is the detailed spatial plan implemented at the lowest level, the detailed city plan. This plan contains zoning regulations and spatial structure plan (detailed urban development plan). Spatial Planning Law also mandates the government in establishing Spatial Planning Information Systems to manage and disseminate related information to all stakeholders, including the citizens (see Figure 9). In practice, zoning arrangement includes information to use as a common reference for all in utilizing land or space while urban development plan contains a list of construction, both for public services or private projects. Capital Investment Law (2007) also mentioned the integration of information about land ownership and public laws in investment. In 2014, The Local Government Law (2014) echoed this task and promoted this information as the core data in local government and permit systems. Bappenas (2012 & 2016) has identified challenges in integrating information of public laws and land administration for national and local development. Its reports highlight coordination problems from the separation of management, asymmetric information from lack of interoperability and data silo practices, and lack of data quality in land administration and spatial planning.

Basic Agrarian Principle Law (1960) prescribes at least eighteen rights (public and private rights) on land parcels (see Table 1) while Spatial Planning Law (2006) delegates authorities to local governments to impose at least eight restrictions and five responsibilities on a property or land parcel (see Table 2 and 3). However, there are some lower regulations enacted to govern rights on land, such as Government Regulation 38 (1963) on Land ownership by a state-owned enterprise, Government Regulation 28 (1977). According to Spatial Planning Law (2006), zoning regulations are configured with certitude in mandatory, dispensation, or prohibition of activity to all spaces. Zoning regulations may be in the form of determination of spatial envelope or provision of public facilities and infrastructures or other forms to create a safe, comfortable, productive, and sustainable use of land. Spatial envelope in zoning regulation may contain criteria, such as the type of land function or activity, the basic coefficient of green space, building base coefficient, building floor coefficient, and building free borderlines. Government of Indonesia (GOI) utilizes spatial planning as the reference for its land-use policy, particularly in governing ownership and utilization of land or space. Land Use Policy Regulation (2004) prescribes landowners to obey spatial planning in using their land. This regulation also specifies that any use of land or space which is not aligned with spatial planning cannot be extended or further developed. Further, this regulation mandates the government to apply incentives and disincentives mechanism in land use policy "to synchronize" existing land use and using spatial planning for future land use through permit systems. In 2011, Indonesian Spatial Information Infrastructure and Open Government

Indonesia were launched (Indrajit 2018). These two initiatives construct institutional arrangement and citizen's participation in accessing and utilizing public information, including land parcel boundaries and spatial plan.

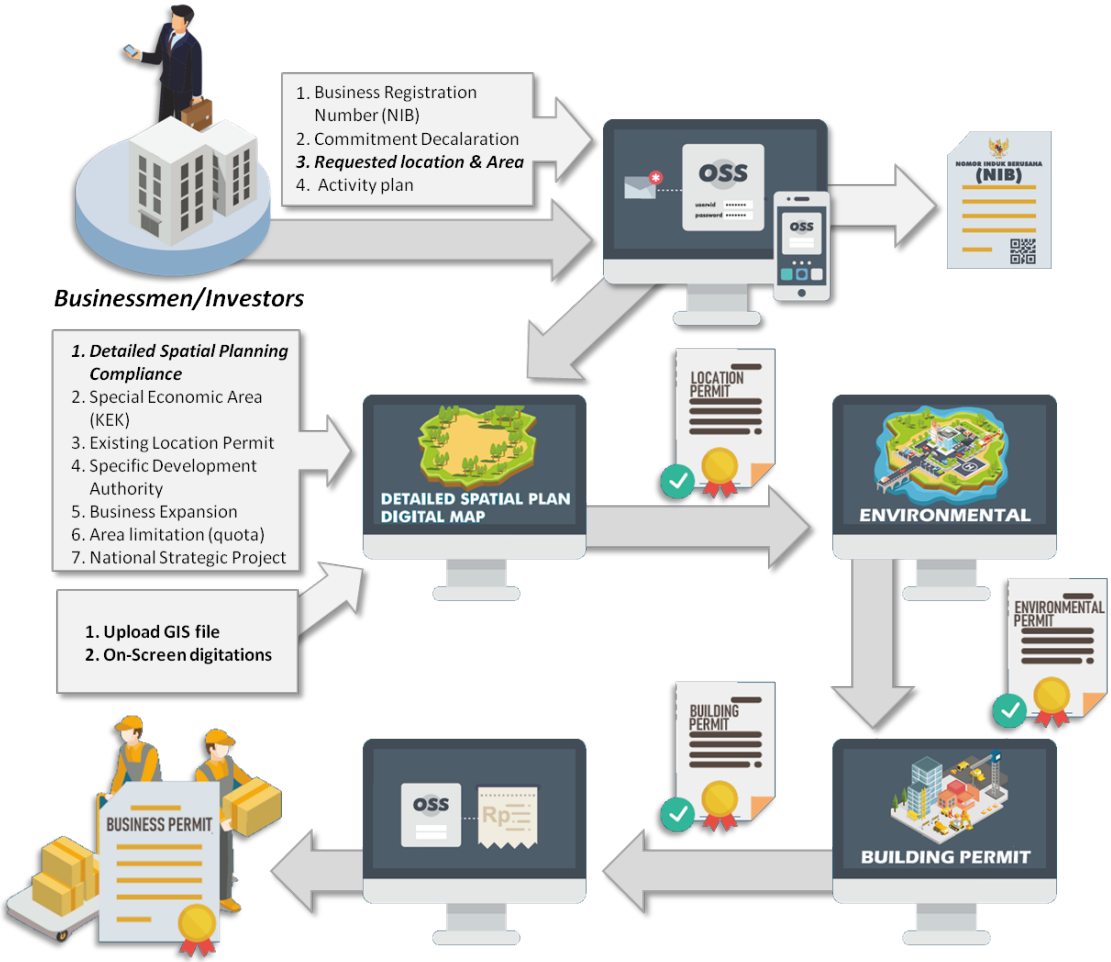


Figure 10. Simplified flow of the One Single Submission (OSS) system in using spatial information and RRRs for issuing the permit (or license) of business (Coordinating Ministry For Economic Affairs Republic Of Indonesia 2018)

On 21 June 2018, Indonesia launched the One Single Submission (OSS), an online platform connecting various authorities for issuing a permit or licensing for business (Delloitte 2018). The OSS is a national-based initiative in improving the ease of doing business in Indonesia. Currently, the OSS serves and operates in 560 central and regional Indonesian Investment Coordinating Board (BKPM). The OSS is maintained by BKPM with local cadastre office and local government to accelerate and to control licensing mechanism. RRRs information is the core data in this system sourced from land administration and detailed spatial (city/municipal) planning. The users (investors and landowners) must provide the proposed location with proper administrative (NIB, current permit, activity plan, and commitment declaration) and spatial documents (land parcel and address). In requesting a business privilege (rights), investors are required to declare a commitment to comply with restrictions

and responsibilities commanded from laws and regulations. The OSS system facilitates the authority in examining the compliance of the proposed location with city planning and environmental regulations (see Figure 10). If the proposed location is not in the proper zoning, then the authority will decline to issue location permit. The spatial zoning contains restrictions and responsibilities in carrying out activities on land parcel or space. Similar to location permit, investors must conduct Environment Impact Assessment (AMDAL) and propose an Environmental Management Plan (UKL) and Environmental Monitoring Plan (UPL) for acquiring Environmental Permit. The UKL and UPL contain a set of responsibilities for parties to preserve the environment in doing activities on land. BPN will consider spatial planning for issuing of land ownership rights, building utilization rights, rights of use, and cultivation rights, as well as for local government in releasing space utilization permit. It is a consequence that data interoperability and information sharing play critical roles in these activities. However, part of activities in both land administration and spatial planning are managing RRRs information and involving multiple parties. This article proposes LADM to be used for integrating information about RRRs sourced from public laws and private law, mainly in the conceptual model and actual implementation. Further, we also promote LADM to be used by spatial planning authorities as an effort to minimize asymmetric information of RRRs among government institutions that responsible in land administration and spatial planning, as well as for businesses and citizens.

6. DISCUSSION

Indonesian cities and municipalities have developed their spatial planning processes based on the combination of state and local legislation with some local considerations and characteristics (culture, politics, geographic setting, and so forth). However, central government still managing land administration processes and Spatial Information Infrastructure (SII) that may be the solution to streamline spatial planning data and to construct an integrated land-related information for land management purposes (land tenure, land use planning, land development, and land valuation) (see Enemark 2004 and van Oosterom et al. 2009). There are three challenges in the OSS, lack of availability of spatial planning information with quality, lack of consistency spatial planning information at city and municipality level, and lack of information sharing between government institutions. The OSS system has not yet implemented an ISO standard for its land information, which caused difficulties in implementation. Problems appear in data collection, data management, maintenance, the relationship between documents (administration and spatial), and time-consuming for information integration (Santoso 2018). The proposed spatial planning information package utilizes LA_SpatialUnit to provide a spatial representation of these criteria, both in 2D and 3D. For example, a land parcel that faces two road types may be assigned with two spatial planning classes (see Parcel “A” in Figure 7.a). We reuse LA_SpatialUnit as to represent a subdivision of a land parcel and to anticipate a case where a land parcel owns two or more criteria derived from spatial planning or other regulations (see LA_SpatialUnit in Figure 4). In each sub-parcel, criteria can be imposed, which can be a 2D or 3D representation. An example of a 2D representation of criteria is a restriction to construct

building beyond on specific distance from the fence (see dashed blue line Figure 7.a). 3D representation of spatial planning provides more insight than 2D, particularly in a mixed zone where each floor may have a different function and visualization. The LA_BAUnit accommodates RRRs differentiation in sub-parcel, which is typical in a city 2D setting (Figur 7.a). Figure 7.b shows the representations of RRRs in a parcel by introducing three types of legal spaces: utility network (LA_LegalSpaceUtilityNetwork), Open Space (LA_LegalOpenSpaceUnit) and Building (LA_LegalBuildingUnit). Each of these spaces has different RRRs prescribed by land administration and spatial planning processes. By defining RRRs of a parcel (and sub-parcel), the proposed Spatial Planning Information Package of LADM can leverage the OSS system by offering better documentation and more realistic representation of a permit (or license) on a parcel. We utilize two LADM classes (LA_LegalSpaceBuildingUnit and LA_LegalSpaceUtilityNetwork) as part of LA_SpatialUnit. We propose LA_OpenSpaceUnit for the area which is restricted for building on a land parcel as LA_SpatialUnit (see Figure 11). Further, spatial planning is an activity that can be revised over time. In consequence, similar to LA_RRR and LA_SpatialUnit, classes in spatial planning information (SP_PlanningBlock and SP_PlanningUnit) shall also be treated as 4D spatial representation (Figure 6 and Figure 11). By representing spatial planning information in 4D (3D+Time), urban planners and landowners will be provided with more detailed visualization of RRRs applied on a land parcel/space over time. There is ongoing information asymmetry, the One Map initiative, a government directive to produce a set of the thematic dataset at scale 1:50000, does not match with the quality of information (geometry and timeliness) demanded by the OSS. In almost two years of its implementation, the OSS system provides access to prospectus investors. In the future, the OSS should be linked with LAS, SII, and open to all, particularly to local governments and landowners affected by business activities. Hopefully, the proposed spatial planning information package can be included in the revision of LADM, especially for application such as the OSS.

Spatial Planning Information Package has been tested in Indonesia case with consideration of existing laws and institutional arrangement (see Figure 11). With the improved LADM country profile, stakeholders can construct better prediction from restrictions and responsibilities (see Figure 11) compared to the existing arrangement (see Figure 8) made in 2012. Furthermore, the improved country profile will accommodate the OSS demands by facilitating RRRs information sourcing from the standardized land administration and spatial planning information. In today's smart city era, smart citizens require more sophisticated information about their assets and neighborhood. They should be able to monitor RRRs of their land or property with convenience at any time for any possible changes in policy and other circumstances. In a complex world, rights have always been paired with restrictions. In many cases, this pair followed by some responsibilities. By accommodating public laws aggregated in spatial planning into land administration, stakeholders may access more complete RRRs information. Data custodian in land management activities (land tenure, land valuation, land use, and land development) shall consolidate their data management, develop interoperability between land-related information and exercise data sharing through SII, as well as minimizing asymmetric information by disseminating relevant information to landowners and businesses.

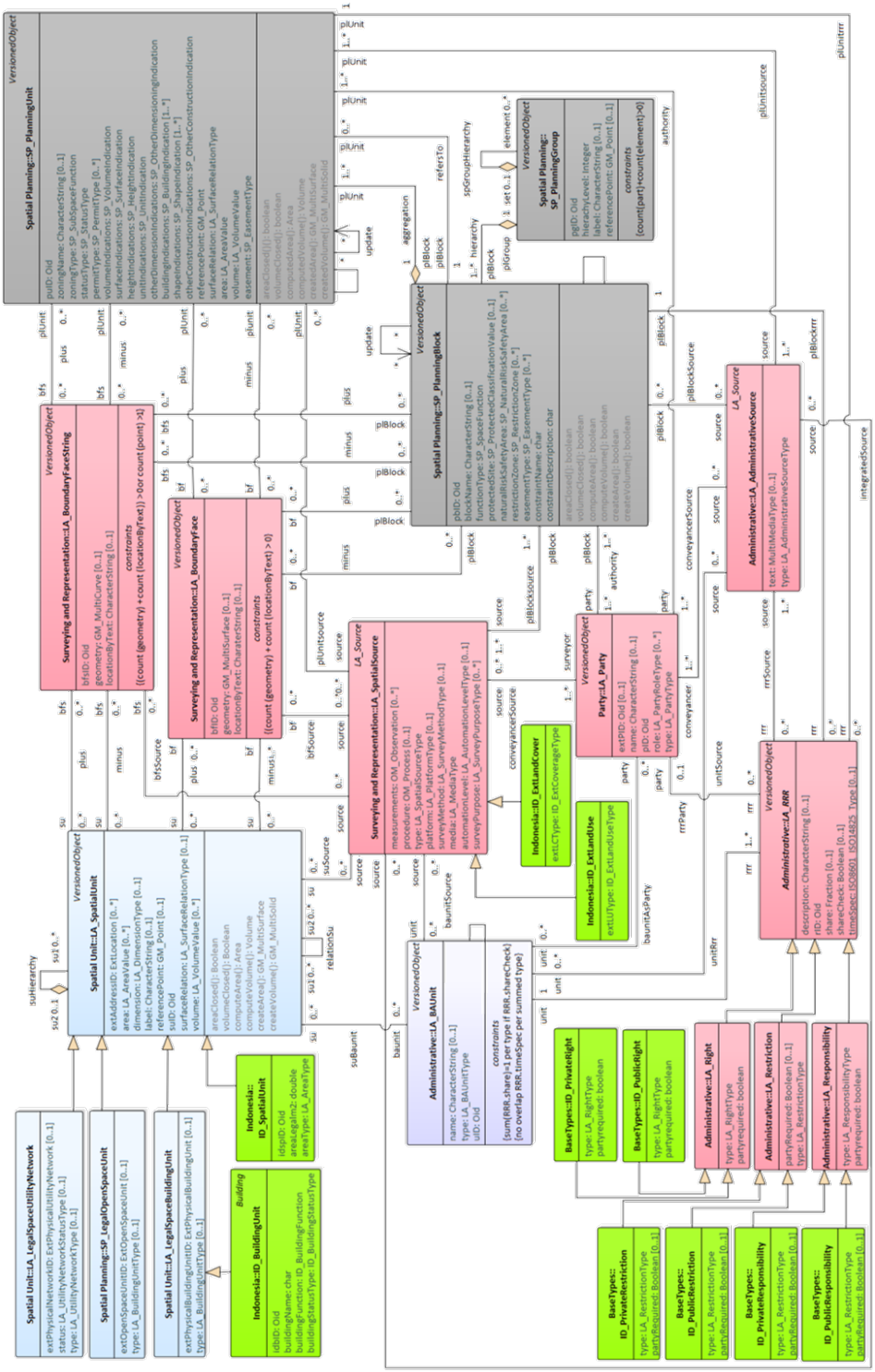


Figure 11. Improved Indonesia LADM Country Profile using (Proposed) Spatial Planning Information Package. Light blue boxes are the core LADM and managed in Cadastral Office, Grey boxes are classes from proposed spatial planning information package managed by local government, red boxes are common classes, and Orange boxes are classes typical for Indonesian characteristics.

Reducing adverse selection is important for effective land market and effective land use management. Interoperability of information plays vital roles in reducing adverse selection. Spatial Planning Information Package supports the integration of RRRs information in reducing hidden RRRs information but also avoiding land market failures. RRRs information should be available to all stakeholders in land management. Authorities, businesses, and landowners may utilize SII to perform "signaling" RRRs information to relevant parties. Businesses and future investors can benefit from the interoperability of RRRs information and open data initiative to perform "screening" through SII before allocating their investment or making decisions. Providing public services to thousands of applicants using RRRs information and legal documents from several sectors within narrow windows of opportunity is a massive challenge for OSS. Without interoperability of RRRs information, it is a nearly impossible task for local government to perform data integration and make decisions in issuing permits or licenses through the OSS system. In longer-term, local governments can utilize interoperability of RRRs information and SII to construct better land market and land use management.

7. CONCLUSION

The integration of information of RRRs derived from spatial planning and land administration is inevitable, particularly in land management and for citizens in performing decision-making over land parcel or space. Both spatial planning and land administration are best viewed in a multidimensional representation, involving geometric, temporal, and thematic aspects. Information from these activities is classified as public goods which should be non-excludable and can be accessed by broader parties, such as landowners and investors. However, some countries are still facing difficulties for having this information ready to be integrated and published. These situations happen due to various reasons, mainly because failure in ensuring information interoperability. The current version of Indonesian LADM country profile provides an approach in improving information interoperability as well as documenting and representing Right of a land parcel or space. We evaluate the proposed Spatial Planning Information Package in the LADM standards to integrate cross-sector policies accommodated in a spatial plan. By using the package, we identify RRRs from land administration and spatial planning and construct the LADM country profile. Further, we utilize the Spatial Planning Information Package to minimize asymmetry information by improving the completeness of RRRs information with spatial representation from spatial planning and land administration. The improved LADM country profile, which then can be used as the foundation of multi-purpose application supporting OSS locally, as well as to SDGs nationally, particularly in cadastre, city planning, and permit system. Our data model can be implemented for land administration in land offices but also applicable in supporting urban planning processes by the city government (see Figure 8). The purpose of implementing LADM beyond land offices will ensure interoperability and better spatial representation of legal spaces within a land parcel and to enable data integration and information utilization. The implementation of Open Government Partnership in Indonesia is directed to harness transparency and participation in strengthening innovation. Information sharing spatial planning and land administration is vital

for any city, particularly for permit issuance and public services. In harnessing fairness and easiness of doing business, a city must guarantee interoperability of information in these activities to minimize asymmetric information among government institutions or between government institutions and investors and landowners. This article presents the benefits and arguments in developing and utilizing the Spatial Planning Information Package of LADM. The improvement of the LADM country profile is used as a pathway to have better documentation of RRRs for all stakeholders, particularly for reducing asymmetric information between stakeholders in spatial planning and land administration.

8. RECOMMENDATION

Our work proposes the urgency to extend the use of LADM beyond cadastre agencies, particularly to the authority that responsible in spatial planning. This step is essential to minimize asymmetric information among public institutions and between local governments and their citizens, and between landowners and prostpectus investors.This articles propose a well-defined LADM country profile with integration of spatial planning information as a product to enable authorities in constructing specifications for improving their land administration system and spatial planning information system. The proposed LADM country profile will also useful for multi-purpose application, particularly in developing permit system and achieving land-related goals and target as prescribed in the UN's Agenda 2030 for sustainable development.

The Spatial Planning Information Package in LADM standard aims to improve interoperability of information derived from land administration and spatial planning process. Thus it will enable more parties in spatial planning, land administration, and others to publish and contribute their information via Application Programming Interfaces (APIs) and Spatial Information Infrastructure (SII). In the future, integration of Building Information Model and CityGML will allow a subdivision of a land parcel as an interface object (LA_BAUnit) to represent complex configuration of RRRs from land administration and spatial planning. Since RRRs derived from spatial planning are multidimensional and time-bounded, we project that more research will be needed for the 4D (3D+Time) representation of legal and social aspect in supporting a digital twin of a city.

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