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Original Research



Optimizing GISTARU: Evaluating a GIS-Based Platform's Contribution to Indonesian Spatial Planning for Smart City Development

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Abstract

GISTARU (Geographic Information System for Spatial Planning) is a web-based and GIS-based information system in Indonesia that makes it easy for the public to access spatial information. In GISTARU, there are an Online Spatial Plan (RTR Online) and an Interactive Detailed Spatial Plan (RDTR) application. This research aims to; Identify and analyze the use of the Online Spatial Plan (RTR Online) website and Interactive Detailed Spatial Planning (RDTR Interactive) application in GISTARU and as well as identify the requirements for developing the website and application. In addition, the research outcomes are analyzed in terms of their contribution to the development of smart cities. Data was collected through in-depth interviews and website searches related to GISTARU, RTR Online, and RDTR Interactive at the national, provincial, and district or city levels. In-depth interview analysis is carried out through selected cases. The results showed that most regions in Indonesia have an integrated spatial pattern with GISTARU. However, there were inconsistencies in the RTR Online and RDTR Interactive data entry in GISTARU. In the meantime, relatively few spatial structure data are integrated with RTR Online. The Interactive Detailed Spatial Plan application is now operational in the majority of Indonesian provinces. The only province in which all regions have implemented interactive RDTR is DKI Jakarta. This Geographic Information System for Spatial Planning is very useful for achieving the goal of smart cities, particularly related to public services in the smart governance dimension.

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1. Introduction

Spatial planning is a process that involves a diversity of actors and activities toward ensuring them all, and this process aims to create diverse recreational spaces that are efficient and equitable, respectful of privacy and individuality, and environmentally friendly (Haughton et al., 2009). Indonesian Law Number 26 of 2007 concerning Spatial Planning states that spatial planning, in general, has the meaning of a system of spatial planning processes, space utilization, and space utilization control (Law of the Republic of Indonesia Number 26 Year 2007 on Spatial Planning). Spatial planning is carried out to produce general spatial plans and detailed spatial plans.

Spatial planning including its legal instruments is the basis of a policy that is needed to ensure the certainty of the effective use of resources to maintain, restore, and enhance biodiversity and ecosystems (Albert et al., 2020). As they contain legally binding guidelines for both governments and residents, every aspect of land use that is influenced by either spatial planning or land administration needs to be recognized, recorded, and standardized (Indrajit et al., 2020).

The outcomes and effectiveness of participatory processes are typically described in spatial planning literature in terms of the improvement and tenacity of the governance system, the empowerment of the community, the operability of strategies, and action during the strategic plan's implementation phase (Lingua & Caruso, 2022; Rachmawati et al., 2018). The implementation of spatial planning in Indonesia is regulated in Government Regulation Number 21 of 2021. The regulation states that the implementation of spatial planning is an activity that includes the regulation, guidance, implementation, and supervision of spatial planning (Government Regulation Number 21 of 2021 concerning the Implementation of Spatial Planning). The form of spatial planning development is through the development of spatial planning information and communication systems. The development of spatial planning information and communication systems is an effort to develop quality, up-to-date, efficient, and integrated spatial planning information, and communication systems. The development of spatial planning information and communication systems is carried out through the provision of databases and information on spatial planning by developing an electronic system network and disseminating spatial planning information to the public.

GISTARU (GIS for Spatial Planning) is a form of spatial planning information and communication system presented by the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN). GISTARU was presented as part of the implementation of the new concept of system-based activity permits and the change of location permitting authority into space utilization approval. This is a mandate from the amendment of Law Number 26 of 2007 concerning Spatial Planning to Law Number 11 of 2020 concerning Job Creation (Zulkarnain & Priyanta, 2021). GISTARU is intended to support local governments in planning, especially in terms of structuring the area. The application is expected to assist spatial planners to conduct a comprehensive area study and coordinate regional development plans to align with the development vision (Arkdata, 2021). As a Geographic Information System (GIS) based application, GISTARU is directed to provide convenience for the public or investors to access spatial planning data, including detailed land use zoning maps (Sutanta et al., 2021; Utami et al., 2021; Wiwaha et al., 2020). The use of web-GIS in spatial planning through GISTARU provides advantages in the form of an inexpensive process, centralized data can be linked to related Ministries/Institutions, and easy to access and integrate with other map sources (Haryanti, 2018). The GIS as a mapping tool assume geographic positions (Oliveira et al., 2022).

The preparation of the database is carried out by considering the Regulation of ATR/BPN No. 1 of 2018 concerning Guidelines for the Preparation of Provincial, Regency, and City Spatial Plan and ATR/BPN Regulation No. 16 of 2018 concerning Guidelines for the Preparation of Detailed Spatial Plan (RDTR) and Regency/City Zoning Regulations for Development and Guidelines and Regulations on the preparation of RDTR in the regions (Regulation of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency of the Republic of Indonesia Number 16 of 2018 concerning Guidelines for the Preparation of Detailed Spatial Plans and District/City Zoning Regulations). However, this regulation is no longer valid and has been changed to Ministerial Regulation of ATR/BPN No. 11 of 2021 concerning Procedures for Compilation, Review, Revision, and Issuance of Substance Approval for Provincial, Regency, City Spatial Planning and Detailed Spatial Plans (Regulation of the Minister of Agrarian Affairs and Spatial Planning/Head of the National Land Agency of the Republic of Indonesia Number 11 of 2021 concerning Procedures for the Preparation, Review, Revision, and Issuance of Substance Approval of Provincial, Regency Spatial Plans). GISTARU consists of two applications, namely the online Spatial Plan (RTR Online) and the interactive Detailed Spatial Plan (RDTR Interactive). Both applications are new things that are important to study.

Spatial planning products contained in GISTARU include Detailed Spatial Plans, Regional Spatial Plans, Spatial Plans, National Strategic Areas, Island/Islands Spatial Plans, and National Spatial Plans, all of which can

be accessed by the public via <https://gistarua.trbnpn.go.id/>. Currently, out of a total of 70 Detailed Spatial Plans that have been issued, 32 Detailed Spatial Plans under GISTARU have been integrated into the Online Single Submission (OSS) system and will continue to be developed ([Directorate General of Spatial Planning Ministry ATR/BPN, 2021](#)). There are still many local governments that have not utilized GISTARU to provide spatial data for each region ([Haryanti, 2018](#)). Meanwhile, on the other hand, the digital transformation presented through GISTARU is expected to facilitate the licensing process for the implementation of existing spatial planning. Considering the important role of GISTARU as a form of digital transformation involvement in spatial planning, research is needed to review the progress of GISTARU that has been going so far.

Disclosure of spatial planning information is one of the challenges in the implementation of spatial planning in Indonesia. The transparency of the process of various spatial planning policies, both the Regional Spatial Plan (RTRW) and the Detailed Spatial Plan (RDTR) is an important thing to realize the implementation of quality spatial planning both from the aspect of regulation as well as guidance and supervision. One form of improving spatial planning is through the development of spatial planning information and communication in the form of developing an electronic system. Through simple online interfaces, the established technology foundation makes it easier to incorporate spatial datasets into the spatial data information. Similar to that, it offers a user-friendly interface that enables users to browse, evaluate, and enjoy its content ([Vaitis et al., 2022](#)).

Currently, the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN) is developing GISTARU as a GIS web-based application to make it easier for the public to access spatial planning maps. However, web-based applications, including GISTARU, generally seem to be fragmented, making it difficult for users to obtain the information and services they want ([Mustofa, 2020](#)). In addition, many local governments have not utilized GISTARU in providing spatial data which has an impact on confusion in the community ([Haryanti, 2018](#)). On the other hand, user needs for the provision of land information service portals are increasing. Thus, research is needed to find out more about the GISTARU application, both in terms of utilization and development needs in the future. Also, how the online Spatial Planning (RTR Online) application and interactive Spatial Detail Plan (RDTR interactive) in GISTARU have been implemented and utilized.

This research aims to; Identify and analyze the use of Online Spatial Plan (RTR Online) website and Interactive Detailed Spatial Planning (RDTR Interactive) application in GISTARU and identify what is needed to develop the website and the application. While existing studies have often focused on the developmental aspects of specific applications, this research seeks to identify patterns, challenges, and future development needs that can be generalized for the advancement of digital spatial planning systems on global scale. The findings aim to provide useful insights that go beyond the local context and offer applicable knowledge for researchers, policymakers, and practitioners involved in the larger field of geospatial technology and land-use planning by addressing the gaps in development and utilization in GISTARU. In addition to adding a layer of depth to the scientific discourse, the analysis of the difficulties faced by web-based applications such as GISTARU and the changing demands of users makes our study relevant and beneficial to a broader readership outside the confines of product development.

2. Data and Methods

The research was carried out through collection and analysis of secondary data obtained through the website. Apart from that, in-depth interviews were also conducted with several relevant sources. The secondary data gleaned from websites related to GISTARU, RTR Online, and RDTR Interaktif at the national, provincial, district, and city levels. The data also be quantitatively and qualitatively analyzed. In addition, a spatial analysis was conducted to illustrate the distribution of usage of the GISTARU, RTR Online, and RDTR Interaktif applications. The quantitative analysis technique consists of a data analysis of the number of Provinces and Regencies/Cities that have implemented RTR Online and RDTR Interaktif. The primary data gathered from indepth interviews with selected informants i.e. with BIG (Geospatial Information Agency), particularly PTR (Spatial Mapping Center and Atlas), the Department of Human Settlements, Spatial Planning, and Land Affairs of DKI Jakarta, and the Department of Land and Spatial Planning of the Special Region of Yogyakarta. The

results of the in-depth interview be analyzed qualitatively. On the basis of the results of the spatial and quantitative analysis, it will be possible to qualitatively identify locations (provinces and districts/cities) where the application and utilization of online RTR and interactive RDTR are already optimal.

3. Result and Discussion

3.1. *GIS for Spatial Planning (GISTARU), Online Spatial Planning (RTR Online) and Interactive Spatial Detail Plan (RDTR Interactive)*

As a support for the industrial revolution 4.0, spatial planning plays a role in connecting and integrating planning between sectors. The emergence of geospatial technology spawned a one-map policy that incorporates the Internet of Things (IoT), Big Data, Cloud Computing, Machine Learning, and Artificial Intelligence (AI). In the field of spatial planning, one of the derivative products of the one-map policy is the spatial geographic information system, or GISTARU (Pratikno et al., 2020). It is anticipated that this web application will support electronic integrated investment licensing or Online Single Submission (OSS). Online Single Submission is an application for a business license submitted via an integrated electronic system (Djasriain, 2022).

GISTARU is a web-based application that provides access to spatial planning-related geospatial data. GISTARU includes national regional spatial plans, border area spatial plans, national strategic area spatial plans, provincial spatial plans, regency/city spatial plans, and detailed spatial plans. GISTARU is operationally managed by the Map Studio, Directorate General of Spatial Planning, Ministry of Agrarian and Spatial Planning/National Land Agency or called ATR/BPN in Indonesia (Wahyuni et al., 2019).

The Ministry of Agrarian and Spatial Planning/National Land Agency (ATR/BPN) is the agency that creates, manages, and oversees the GISTARU Application. The Geospatial Information Agency (Badan Informasi Geospasial / BIG) as the agency in charge of maps in Indonesia only has a role as a provider of base maps (Results of in-depth interviews). There is no direct cooperation from the Ministry of ATR/BPN with BIG regarding the request for data/base maps as the source of GISTARU data. Data from BIG can be accessed openly, through the Geospatial Information Agency's portal, called Inageoportal. However, it is not certain whether the base map data used in GISTARU is a base map from BIG. It is not possible to confirm whether the base map that has been approved by BIG is the map that is used as the input data in the planning maps displayed in GISTARU. It is possible that the base map used is the map of the relevant local government itself. Following are the results of in-depth interviews with informants from the Center for Spatial Mapping and Atlas, Geospatial Information Agency:

“Because BIG is still unable to provide all possible base maps, regions can apply to make their own base maps. BIG has 5 days to decide whether to grant permission or not. Regions that apply can also ask for assistance from Geospatial Information Agency for the required base map specifications”

However, until now no one has been able to guarantee whether the map inputted by the local government into the RTR Online or RDTR Interactive database is the same base map as the one that has been validated by BIG. This is still something that is not certain regarding the source of this GISTARU data. At the licensing service practice stage, GISTARU through the Interactive RDTR is used as the basis for approval of the suitability of space utilization for a type of activity plan. Interactive in the context of utilizing web GIS is considered the most comprehensive method to accommodate increasingly dynamic spatial challenges based on data entry that can be analyzed more deeply (Lorek & Horbiński, 2020). This system does not run alone, but is integrated with other licensing systems, such as SimBG for building permit services, and Amdalnet for environmental feasibility approval. However, GISTARU through the Interactive RDTR is the first screening related to licensing activities in a location, especially urban areas (Soekemi, 2022). GISTARU supports the spatial planning process, by facilitating access and understanding for the community in planning activities that utilize space (Indrajit et al., 2021; Rachmawati et al., 2018). GISTARU is a Spatial Planning (RTR) application created to display layers of spatial data that have been inventoried by the Ministry of Agrarian and Spatial Planning.

The layer used comes from the network node of the ministry/institution and local government that is the guardian of the data.

GISTARU is divided into 4 sub-platforms, including (Directorate General of Spatial Planning Ministry ATR/BPN, 2022): 1) RTR Online to access general spatial plan data such as national, provincial, and city or district spatial plan; 2) RDTR Interaktif to access detailed spatial planning data, and equipped with location-based and activity-based search features; 3) Sifataru: A Web-based and WebGIS-based Spatial Information System which contains data and information on the development of the implementation of Spatial Utilization in the National Territory, Islands/Islands, and National Strategic Areas (KSN) as well as the Spatial Plan Synchronization Program with development plans that are integrated with multilateral information systems. SIFATARU consists of Synchronization Module of Spatial Utilization Program, Monitoring and Evaluation Module of Spatial Planning Implementation, and Spatial Utilization Map; and 4) ModuleProTaru: Application of data and information management related to the progress of spatial planning activities and regional space utilization carried out by the provincial, district, and city governments.

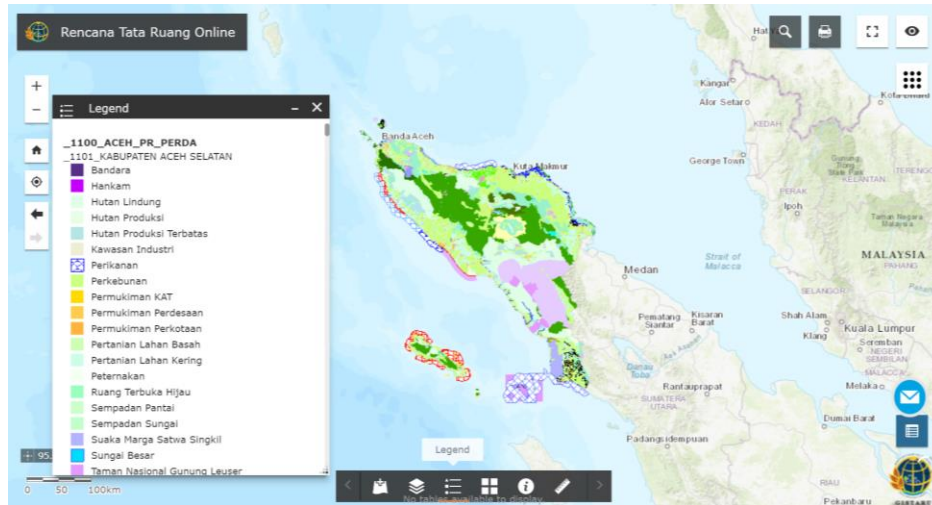
Technical instructions on how to use the SITARU application are explained online, an example is the one implemented at the Yogyakarta City Land and Spatial Planning Office (Rachmawati, 2021). It is explained that some of the key steps in using the application are; first, open the Play Store on the Android phone; second, type SITARU in the search field, then install; third, activate the GPS, then open the SITARU application from the android phone. The user can directly select the desired location to find the zone and its status. However, not many people recognize this application and use it, for that social media can be used to expand its use (Rachmawati, 2021).

3.2. Utilization of RTR Online (Online Spatial Planning) and RDTR Interactive (Interactive Detailed Spatial Plan) Applications in the GIS for Spatial Planning (GISTARU)

Regarding the use of the RTR Online application and RDTR Interactive application, data collection is carried out through data searches on the internet. According to the results of a data search conducted on the gistaru.atrbpn.go.id page, Regional Spatial Planning which is already integrated with GISTARU's RTR Online can be seen in Table 1. The results of the data search (see Table 1) show that most regions in Indonesia have integrated spatial pattern data with GISTARU, but only a small number of regions have not been fully integrated, such as North Sumatra Province, Riau Province, DKI Jakarta, Southeast Sulawesi Province, West Sulawesi Province, Papua Province, and West Papua Province. Meanwhile, not much Spatial Structure data is integrated with GISTARU's RTR Online. Of the 34 provinces in Indonesia, only eight provinces have 100% availability of spatial structure data, namely Jambi Province, Banten Province, West Java Province, East Java Province, Special Region of Yogyakarta, West Kalimantan Province, Province, South Kalimantan, and East Kalimantan Province. There are 14 provinces in Indonesia where the total availability of spatial structure data is still 0%.

Identification of the availability of Detailed Spatial Plan data in GISTARU's RTR Online shows that East Java Province is the province with the most data availability in Indonesia, namely 40 RDTR data. This number is very unequal compared to other provinces where most of the data availability is below 10 and some provinces also have no data available.

RTR Online, as shown in Figure 1, can be used by business actors to find out information about space allocation in a location based on spatial plans that have become legal products such as Government Regulations, Presidential Regulations, Provincial Regulations, and Regency/City Regional Regulations (Kementerian Investasi/BKPM, 2021). Especially for business activities located in areas that do not yet have an OSS-integrated Detailed Spatial Plan. For areas or locations that still do not have a Detailed Spatial Plan yet, the suitability of space utilization activities is carried out using the approval mechanism for the suitability of space utilization activities (PKKPR) issued through the OSS system, either automatically or through preliminary assessment (Ministry of Investment/BKPM, 2021).



Source: gistaru.atrbpn.go.id/rtronline/, 2022

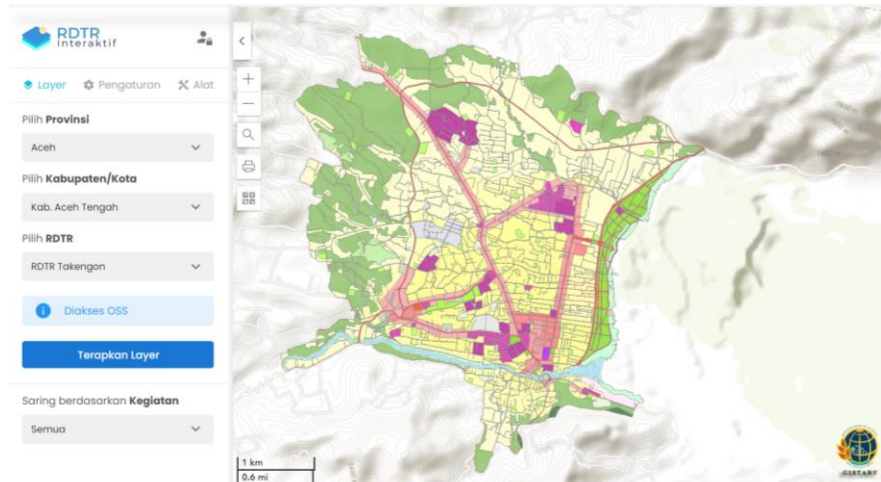
Figure 1. The RTR Online Web-GIS Application

Table 1. Total Availability of Spatial Pattern, Spatial Structure, and Detailed Spatial Plan Data on GISTARU's RTR Online in Indonesia

Province	Total District/City	RTR ONLINE					
		Spatial Pattern	%	Spatial Structure	%	Detailed Spatial Plan	
Aceh	23	23	100%	21	91%	3	
Sumatera Utara	33	29	88%	22	67%	4	
Sumatera Barat	19	19	100%	17	89%	4	
Sumatera Selatan	17	17	100%	14	82%	3	
Riau	12	7	58%	0	0%	4	
Kepulauan Riau	7	7	100%	5	71%	3	
Jambi	11	11	100%	11	100%	1	
Bengkulu	10	10	100%	9	90%	0	
Bangka Belitung	7	7	100%	6	86%	5	
Lampung	15	15	100%	14	93%	2	
Banten	8	8	100%	8	100%	3	
Jawa Barat	27	27	100%	27	100%	12	
Jawa Tengah	35	35	100%	32	91%	11	
Jawa Timur	38	38	100%	38	100%	40	
DKI Jakarta	6	0	0%	0	0%	0	
Yogyakarta	5	5	100%	5	100%	7	
Bali	9	9	100%	0	0%	5	
Nusa Tenggara Barat	10	10	100%	0	0%	6	
Nusa Tenggara Timur	22	22	100%	0	0%	8	
Kalimantan Barat	14	14	100%	14	100%	7	
Kalimantan Selatan	13	13	100%	13	100%	4	
Kalimantan Tengah	14	14	100%	8	57%	2	
Kalimantan Timur	10	10	100%	9	90%	4	
Kalimantan Utara	5	5	100%	5	100%	1	
Gorontalo	6	6	100%	0	0%	1	
Sulawesi Selatan	24	24	100%	0	0%	11	
Sulawesi Tenggara	17	16	94%	0	0%	0	
Sulawesi Tengah	13	13	100%	0	0%	5	
Sulawesi Utara	15	15	100%	0	0%	0	
Sulawesi Barat	7	6	86%	1	14%	1	
Maluku	11	11	100%	0	0%	1	
Maluku Utara	10	10	100%	0	0%	1	
Papua	29	21	72%	0	0%	2	
Papua Barat	12	9	75%	0	0%	3	

Source: gistaru.atrbpn.go.id/rtronline/, 2022

The RDTR Interactive Web-GIS application, as shown in Figure 2, is specifically intended for business actors to find out the types of activities that are permitted at a location in an area that already has a Detailed Spatial Plan. The ease of accessing the information on the allocation of a location helps businesspeople determine the location of their business. After confirming the location designation through the RDTR Interactive, business actors can immediately apply for the suitability of spatial use activities using the automatic confirmation of the suitability of space utilization activities (KKKPR) issued through the OSS system (Ministry of Investment/BKPM, 2021). Interactive RDTR is currently being implemented in 27 provinces in Indonesia. The number of cities/districts that have implemented Interactive RDTR from each province is still diverse, with a total of 77 cities/districts in Indonesia. The only province where all regions have implemented interactive RDTR is DKI Jakarta. Unlike other provinces, DKI Jakarta has one RDTR data covering the entire region.



Source: (gistaru.atrbpn.go.id/rdtrinteraktif/ on 12 May 2022)

Figure 2. The RDTR Interactive Web-GIS application

The Detailed Spatial Plan in the RDTR Interactive for administrative areas in the form of a municipality has covered the entire area within the city, while for an area in the form of a district the Detailed Spatial Plan only covers a certain area. For example, Sleman Regency has 2 Detailed Spatial Plans (RDTR Sleman Barat - RDTR Sleman Timur) in RDTR Interactive and there are still many areas within Sleman Regency that are not included in the scope of the detailed spatial plan. Meanwhile, the City of Yogyakarta has one Detailed Spatial Plan data covering the entire city area. The district with the most detailed Spatial Planning data on this Interactive RDTR site is Pasuruan Regency, with 4 RDTR. According to the results of a data search conducted on the Gistaru.atrbpn.go.id, a Detailed Spatial Plan that is already integrated with GISTARU's RDTR Interactive can be seen in Table 2.

The difference in data between RTR Online and RDTR Interactive is something that is encountered in this data search process. Even though it is a site in the same application (GISTARU), there are quite a lot of differences in the data displayed. For example, for the Malang Municipality, in the RDTR Interactive, there is only one Detailed Spatial Plan Data, namely the Central Malang RDTR, while there are six Detailed Spatial Plan Data of Malang Municipality can be found in the RTR Online. Based on the data search, it can also be seen that even though the title of the site is RDTR Interactive, the number of RDTR (Detailed Spatial Plan) in RDTR Interactive is much less than the RDTR (Detailed Spatial Plan) displayed on RTR Online. This is an important input for the development of GISTARU. The level of data integration is one of the keys to using web GIS for multi-planning needs, especially development planning at the regional level (Zhou et al., 2017). Furthermore, the level of data integration in the use of web GIS can be developed to the point where every user can access information with a mobile phone (Kalinka et al., 2020). In the context of spatial planning, web GIS can be integrated with reporting features to monitor frequent land use violations (Sejati et al., 2020).

Table 2. Data on the Implementation of RDTR Interactive in Indonesia

Province	Municipality/ District	Total	Detailed Spatial Plan (RDTR)
Aceh	Aceh Tengah	1	RDTR Takengan
	Aceh Barat	1	RDTR Meulaboh
Bali	Badung	3	RDTR Kuta, RDTR Kuta Utara, RDTR Kuta Selatan
	Denpasar	1	RDTR WP Utara
DKI Jakarta	Jakarta Pusat	1	RDTR DKI Jakarta
	Jakarta Utara		
	Jakarta Barat		
	Jakarta Selatan		
D.I. Yogyakarta	Jakarta Timur	1	RDTR Siung-Wediombo
	Gunungkidul	2	RDTR Kawasan Sleman Timur, RDTR Kawasan Sleman Barat
	Sleman	1	RDTR Kota Yogyakarta
Gorontalo	Gorontalo	1	RDTR Kota Gorontalo
Jambi	Sungai Penuh	1	RDTR Kota Sungai Penuh
	Kab. Bandung	2	RDTR Bojongsong, RDTR Tegalluar
Jawa Barat	Sumedang	3	RDTR Perkotaan Sumedang, RDTR Ujungjaya, RDTR WP Paseh
	Subang	1	RDTR Kotabaru Patimban
	Kota Bandung	1	RDTR Kota Bandung
	Kota Cirebon	1	RDTR Kota Cirebon
	Kota Depok	1	RDTR Kota Depok
Jawa Tengah	Banyumas	1	RDTR Perkotaan Purwokerto
	Batang	1	RDTR Tulis
	Cilacap	1	RDTR Perkotaan Cilacap
	Jepara	1	RDTR jepara
	Purworejo	1	RDTR Purworejo Kutoarjo
	Sragen	1	RDTR Kawasan Perkotaan Sragen
	Sukoharjo	1	RDTR Perkotaan Kartasura
Jawa Timur	Lamongan	1	RDTR Paciran
	Pasuruan	4	RDTR Grati, RDTR Gembol, RDTR Pandaan, RDTR Wonorejo
	Kota Kediri	1	RDTR Kota Kediri
	Kota Malang	1	RDTR Malang Tengah
Kalimantan Barat	Kota Pasuruan	1	RDTR Kota Pasuruan
	Ketapang	2	RDTR Perkotaan Ketapang, RDTR Kuala Tolak KualaSatong
Kalimantan Tengah	Kotawaringin Timur	2	RDTR Kawasan Perkotaan Mentawa Bru Ketapang, RDTR KPI Bangendang
	Gunung Mas	1	RDTR Gunung Mas
Kalimantan Timur	Kutai Timur	2	RDTR Bengalan Kaliorang, RDTR Kawasan Perkotaan Sangatta
	Bangka	2	RDTR Perkotaan Merawang, RDTR Perkotaan Sungailiat
Kepulauan Bangka Belitung	Belitung Timur	2	RDTR Gantung, RDTR Perkotaan Manggar
	Bintan	2	RDTR Tanjunguban, RDTR WP Teluk Lobam Kuala Sempang
Kepulauan Riau	Tanjung Pinang	1	RDTR Tanjung Pinang
	Lampung	1	RDTR Ginting
Maluku	Tanggamus	1	RDTR Ginting
	Kota Ambon	1	RDTR Pusat Kota Mabon
Maluku Utara	Halmahera Selatan	2	RDTR BWP Kawasan Perkotaan Wayauwa Bibinoin, RDTR Kawasan Perkotaan Labuha
	Bima	1	RDTR WP Kecamatan Monta
	Lombok Tengah	1	RDTR Sekitar KEK Mandalika
Nusa Tenggara Barat	Lombok Utara	1	RDTR Tanjung
	Kota Bima	2	RDTR BWP Mpunda, RDTR WP Rasanai Barat
Nusa Tenggara Timur	Alor	1	RDTR Perkotaan Kalabahi
	Ende	2	RDTR Ende, RDTR Ende Kalimutu
	Nagekeo	1	RDTR Perkotaan Mbay
Papua	Jayapura	1	RDTR BWP Sentani
	Fakfak	1	RDTR Fakfak
Papua Barat	Teluk Wondama	1	RDTR Rasiei
	Pelalawan	1	RDTR Langgam
Riau	Siak	2	RDTR Sekitar KI Tanjung Buton, RDTR Siak Sri indrapura
	Dumai	2	RDTR Pekotaan dan Industri kOta Dumai, RDTR Medang Kampai
	Barru	1	RDTR Kawasan Emas Barongkong
Sulawesi Selatan	Luwu	1	RDTR Perkotaan Belopa
	Luwu Utara	1	RDTR Perkotaan Masumba
	Maros	1	RDTR Moncongloe
	Pinrang	1	RDTR Perkotaan Pinrang
	Soppeng	1	RDTR Perkotaan Watansoppeng
Sulawesi Tengah	Poso	1	RDTR Tentena
	Parigi Moutong	1	RDTR Perkotaan Parigi
Sumatera Barat	Banggai Laut	2	RDTR Banggai Kawasan II, RDTR Kawasan Perkotaan Banggai
	Sijunjung	1	RDTR Muaro Sijunjung
Sumatera Selatan	Kota Payakumbuh	1	RDTR Kota Payakumbuh
	Banyuasin	1	RDTR Pangkalanbalai
Sumatera Utara	Batubara	3	RDTR Batubara, RDTR Kuala Tanjung, RDTR WP Tanjung Tiram dan Talawi
	Tapanuli Selatan	1	RDTR Batangtoru
	Tapanuli Utara	1	RDTR Tarutung Sipoholan Siatasbarita
	Kota Medan	1	RDTR Kota Medan

Source: (gistarua.trbnp.go.id accessed on 12 May 2022)

RDTR Interactive only contains RDTR (Detailed Spatial Plan) that has been integrated with the OSS system, while on the RTR Online menu, the RDTR (Detailed Spatial Plan) displayed is all RDTR (Detailed Spatial Plan) that has been determined by PERDA (Regional Regulations) or PERKADA (Regional Head Regulations) (Results of In-depth Interview with informants). It can be seen in comparison from [Table 1](#) and [Table 2](#), in the D.I.Yogyakarta region, of the six Detailed Spatial Plans (RDTR) that can be seen in the RTR Online, only four Detailed Spatial Plans (RDTR) can be seen in the RDTR Interactive. This is because of the six RDTR data that have been set, only four have been integrated with the OSS system.

RTR Online and RDTR Interactive are here to answer the government's commitment to integrating spatial planning into online spatial planning permits as mandated in Law No. 11 of 2020 concerning Job Creation Article 14 Paragraph 2. However, in practice, a lot of spatial information in the regions is not available and cannot be displayed in GISTARU. This is still an obstacle in the development of GISTARU. The local government hopes that this interactive and online context can really be applied in the form of data synchronization and the availability of online integration services as conveyed by an informant from the Department of Human Settlements, Spatial Planning, and Land Affairs of DKI Jakarta as follows:

For the development of GISTARU, it is necessary that the data can be synchronized and there is an online integration service, not after a regional regulation is passed then the map is being completed and submitted. Our RDTR adheres to the Indonesian Standard Classification of Business Fields (KBLI), which is dynamic. So, in the future, GISTARU should be more dynamic.

3.3. The Need to Develop RTR Online (Online Spatial Planning) and RDTR Interactive (Interactive Detailed Spatial Plan) Applications in the GIS for Spatial Planning (GISTARU)

Based on the data search results, in the GISTARU, users can only search data and retrieve data information. No menu can facilitate users to be able to interact in two directions. In addition, there is also no menu to download existing information, application users can only view the information. Therefore, in the future, the application needs to be developed again so that it allows for interaction.

The results of interviews with informants showed that the GISTARU is quite capable of getting information about spatial planning. However, a menu still needs to be added to be able to connect directly to the OSS application. The addition of the menu that connects directly to the OSS application will be very useful for users, especially those who will carry out permits in space utilization. Users can first check whether the space utilization plan to be carried out is in accordance with the spatial plan set by the government. With this menu, users do not need to open two applications simultaneously to perform permissions.

In Indonesia, the Detailed Spatial Plan (RDTR) currently has included three-dimensional information such as basic building coefficient (KDB) and building floor coefficient (KLB). However, RDTR Interactive in GISTARU can only display Detailed Spatial Plan (RDTR) in two dimensions. If three-dimensional information can be displayed, users can easily access information in how the form of the polar money plan in the RDTR, including the maximum number of floors and the maximum building area in one plot.

One of the uses of the GISTARU is to support sectoral digital-based licensing services through the arrangement of approvals for the suitability of space utilization. However, this system has not been fully integrated with the building approval process through SIMBG and the environmental service approval process through Amdalnet ([Amir et al., 2022](#); [Soekemi, 2022](#)). Full integration of the three systems is needed to support the efficiency of the space utilization permit process in online-single submission (OSS).

3.4. GIS for Spatial Planning (GISTARU) and Smart City Development

The existence of GISTARU, RTR Online, and RDTR Interactive can provide benefits for users to obtain spatial information and spatial permits easily and through online systems. This indicates that public services

provided by the government online can improve government performance in the provision of good public services and support the achievement of smart cities, especially the dimensions of smart governance. Smart Government is one of the elements that must be fulfilled to realize a smart city. In general, smart government is a term that refers to the effective implementation of ICT in public services and government (Giffinger et al., 2007). That means the government in smart city program promotes digital technology toward better city management (Rachmawati, 2019a). Smart government harnesses the power of "data" to improve public services; enable an integrated service experience; to engage with citizens; to formulate policies; and to implement solutions for the welfare of the community. By providing easy access to services and information, smart governance is a way for the government to utilize new technology to better serve the community (Allwinkle & Cruickshank, 2011; Rachmawati et al., 2022).

DKI Jakarta has developed its own online RDTR system via the Jakarta Satu portal in order to accommodate the limitations of GISTARU's existing functions (jakartasatu.jakarta.go.id). Jakarta Satu is an Integrated Monitoring System constructed using data from all Regional Government Agencies in a single base map as a reference for DKI Jakarta Provincial Government decision-making. The utilization of RDTR Online in Jakarta Satu is intended to expedite the licensing of businesses in DKI Jakarta. It is hoped that integrating the spatial data of the Jakarta spatial planning area with the DKI Jakarta One Stop Service (PTSP) will make the permit control process more transparent to the general public. Transparency is regarded as a crucial aspect of smart city development, particularly the smart governance dimension (Johannessen & Berntzen, 2018).

Through the Jakarta One portal, DKI Jakarta is regarded as a model for developing smart cities. By developing Smart RDTR 2022, more functions that cannot be displayed systemically in GISTARU, such as Information on Independent City Plans (IRK), Confirmation of Suitability of Space Utilization Activities (KKKPR), and building intensity calculation simulations, can be accommodated. Thus, the function of providing public services to support enhancing the performance of government services can be realized, and smart governance has been implemented with regard to public services. Currently, a number of regions have been unable to implement the online RTR and interactive RDTR in this GISTARU. Therefore, the relevant ministry, in this case the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (ATR/BPN), must conduct an evaluation of its implementation. However, each region must strive to maximize the delivery of public services. Similarly with regard to the provision of these regulatory details. To support the success of every local government agency, including the development of electronic-based public services, each region must have collaborative and inventive leadership. To support the success of each local government agency, including the development of electronic public services, each region requires leadership that is collaborative and innovative (Rachmawati et al., 2022).

3.5. Discussion

According to informant interviews, the RTR Online in the GISTARU can only display information in one direction and has not been integrated. On the RDTR Interactive, however, the menu display is interactive and more useful. Users of RDTR Interactive are already conscious of an area's zoning regulations. In addition, it is possible to determine whether the land use plan that adheres to the Indonesian Standard Field Classification standard is in accordance with the spatial designation plan. However, if the zoning regulations are classified as conditional and limited, it still does not specify what requirements must be met and what the land use restriction is.

A government employee can use an online spatial data visualization tool as a data communication tool. Online spatial data visualization technology provides free and open access to data at the point of use and can provide better data information than other methods of data presentation, particularly for non-experts (Armstrong-Moore et al., 2021). Unfortunately, the relevant agencies do not fully comprehend the existence of the RTR Online and RDTR Interactive applications in GISTARU. Not all regions have filled in data on RTR Online and RDTR Interactive, as evidenced by search results. Due to the newness of the two applications, it is also necessary to improve their comprehension. Local governments require technical assistance for its implementation.

Numerous nations have implemented spatial planning reforms with substantial ramifications for their ability to promote integrated, adaptive, and collective planning decisions (Nadin et al., 2021). Building a planning support system that is integrated with building and transportation simulations to support the design of urban systems can be accomplished by reviewing the most recent trends from platforms associated with geographic information systems and spatial planning or modeling (Yoshida et al., 2020). In the past, Participatory GIS has been emphasized as a change from traditional mapping and GIS. Participatory geo-information has evolved and can improve participatory spatial planning, including via Participatory GIS (McCall & Dunn, 2012). It is also expected that GISTARU will be an application that supports spatial modeling and participatory GIS. The spatial modeling aspect has been noticed, but not the participatory content. This is due to the fact that this application continues to provide unidirectional information.

There are not enough references related to RTR Online and RDTR Interactive in GISTARU so comparisons with the results of previous studies are difficult to do. As a reference point for additional research, it is necessary to examine examples from other countries. In addition, references linking urban planning and smart cities are still extremely limited. Meanwhile, synchronization between regional development plan products such as the Long-Term and Medium-Term Development Plans (RPJPD and RPJMD) was already carried out when preparing the Smart City Masterplan, and vice versa (Rachmawati, 2019b).

4. Conclusion

In conclusion, our investigation highlights the discrepancies that currently exist in GISTARU's RTR Online and RDTR Interactive data input. Despite these obstacles, the majority of Indonesian regions have effectively incorporated spatial pattern data into the GISTARU framework, suggesting that the adoption of this framework is trending in the right direction. Still, there isn't much connection between GISTARU's RTR Online component and Spatial Structure data. With the interactive RDTR currently widely used in all Indonesian provinces, the application's regional acceptance has advanced significantly. Surprisingly, DKI Jakarta is unique in that all areas have completely adopted the interactive RDTR capability.

Despite the drawbacks of GISTARU's unidirectional information display in some applications, it is critical to acknowledge the system's critical role in furthering the goal of smart city development. The GIS for Spatial Planning is a valuable tool for achieving smart city goals, especially when it comes to improving public service performance in the context of smart governance. With further work to be done on integrating data and application functionality, GISTARU's influence on Indonesia's smart city development trajectory might grow as continue to optimize the system. In the future, a good online spatial planning model needs to be implemented through activating online RTR and interactive RDTR in every municipality and regency, also for the provincial level. On the other hand, users of this application also need to get sufficient information to be able to access it.

The results of this research reveal more practical and implementable matters. However, from a scientific perspective, it can be explained that spatial planning has so far been available in the form of blueprints or documents that are rigid and difficult to upgrade. Currently, through advances in information and communication technology (ICT), changes in spatial planning can be made in a more dynamic way. Apart from that, it also makes it easier to access spatial planning products online. Real things have changed a lot in the current era of ICT development. Future research needs to carry out case studies in one of the cities, districts or provinces in more detail to reveal the level of success in providing online RTR and interactive RDTR data, which has not been done in depth in this research.

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