The Integration of Regional Spatial Planning (RTRW) and Coastal Spatial Planning (RZWP3K) for The Sustainable Coastal Area Development

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Abstract. The disharmony between land and marine spatial planning is threatening the planning of sustainable coastal development. In Indonesia, land spatial planning has firstly been implemented, followed by the spatial zoning of coastal waters. Therefore, to achieve sustainable coastal zone management, the harmonization between the regional spatial plan or RTRW with the zoning plan for coastal waters and small islands or RZWP3K is urgently needed. This paper aims to examine the spatial problems in the process of integrating these two spatial plans. Using the spatial review method, the stages of study consist of forming the seamless spatial planning maps of 8 provincial regions in Indonesia that have stipulated the second regional regulation on spatial planning regimes and then integrated them with the coastal waters spatial planning zonation map (rzwp3k). The findings show the potential conflict in some areas, especially in protected areas with cultivation and public use, and between the cultivation areas, fisheries, and industries. Other findings are on the technical aspect, which shows the differences in the coastal area due to the use of two different coastlines and base maps. Regarding substance, there are differences in the content of the framework of the RTRW and RZWP3K mandates in regional regulation.

1. Introduction
The regional spatial planning (RTRW) plays important role in national development because this RTRW serves as a spatial model to integrate and harmonize all development plans from sectoral and regional. Without regional spatial planning, national development will be hampered because of lack of planning reference. According to [7] general spatial planning in Indonesia play an important rule as a set of reference for such activities as follow: spatial use or regional development, to achieve a balance of development in the region, to find investment locations for the development, to control the use of space in regional development including the establishment of zoning regulations, permits, giving incentives and disincentives, as well as the imposition of sanctions, and inland administration purposes.
The purpose of general spatial planning refers to Law No.26 of 2007 is to create a national space that a safe, comfortable, productive and sustainable of national space. This definition of national space is actually including land space, sea and air, as well as space within the earth. Therefore, the spatial plan map should not only consider land but also sea and air as a unit of mapping [3]. The central government and local governments are obliged to complete a spatial plan map, after the stipulation of Law No.27 of 2007 concerning Management of Coasts and Small Islands, which was later amended by Law No.1 of 2014, these government and local governments are also obliged to prepare a plan coastal management and small islands.

Integration of land and marine spatial planning (coastal zoning) is important concerning the evaluation of new programs or policies with a spatial dimension. The role of geospatial information is important as a spatial model for integrating land and sea spatial plans and seeing the harmonization and synchronization of development planning programs in both terrestrial and marine sectors. Policy of synchronization and harmonization are useful for seeing a spatial model so that problems and constraints that may occur can be identified [2]. The disharmony between land spatial planning and marine spatial planning has been threatening the planning of sustainable coastal development. In Indonesia, land spatial planning has firstly been implemented, followed by the spatial zonation of coastal waters. Therefore, to achieve sustainable coastal zone management, the harmonization between the regional spatial plan or RTRW with the zoning plan for coastal waters and small islands or RZWP3K is urgently needed.

This paper aims to examine the spatial problems in the process of integrating these two spatial plans. Therefore, the purpose of this study is to determine the level of harmonization between RTRW and RZWP with a spatial approach through spatial data integration techniques. It is hoped that the results of this integration will provide input regarding the implementation of the RTRW in the aspects of coastal and coastal area management. Besides, it is also expected to provide a complete picture of spatial planning that includes the arrangement of land to coast areas in one management area.

2. Materials and Methods

The method applied in this research was integration of spatial datasets analysis. In this integration analysis, several spatial analyses have been carried out with perspective of a geographic information system (GIS) [1] [6] [9]. The method of spatial integration has been widely used in kind of research using GIS techniques and remote sensing data, for land and marine model [4] [5]. The input data set used were a dataset of provincial and district spatial planning maps (RTRW of province and district level) and coastal spatial plan maps (RZWP3K), resources from the Center for Atlas dan Spatial Mapping (PTRA) of the Geospatial Information Agency (BIG), these data were produced by local governments and have received a letter of recommendation of BIG status between 2015-2018.[3]

The scope of data integration activities consists of three activities, as follows: (1) data identification: Collecting and digitizing of RTRW and RZWP3K, (2). Data Integration: overlay, scoring in GIS format and perform seamless spatial map. (3). Synchronization and Harmonization analysis between RZWP3K and RTRW map in which data has been seamless [3]. Flowchart of research is shown in Figure 1.

Using the spatial review method, the stages of study consist of forming the seamless spatial planning maps of 6 provincial regions in Indonesia that have stipulated the second regional regulation on spatial planning regimes and then integrated them with the coastal waters spatial planning zonation map (rzwp3k). The five provinces area were selected as the study area because that area was considered as representative of Indonesia also the available for data completeness. Flowchart of research and name of provinces as the study area is shown at Figure 1 and Table 1.
3. Result dan Discussion

Integration and synchronization are important to see problems that arise as a result of the two maps were combined. To answer the objectives of this study in determining level of harmonization between RTRW and RZWP with a spatial approach through spatial data integration techniques, the discussion will focus on three issues, namely (1) the results of identification of RTRW and RZWP maps related to mapping and substance aspects, (2) the results of the spatial integration between the provincial RTRW maps at the provincial and district / city levels and (3) the results of the analysis of the synchronization between these two spatial maps.

3.1. Identification status of the RWRW and RZWP3K

The national spatial planning was compiled based on an administrative area approach that hierarchically consists of the National RTRW, Provincial RTRW and Regency / City RTRW. The General National Spatial Plan is a policy direction and strategy for the utilization of national territory space which is formulated to maintain national integrity, balance and harmony of developments between regions and between sectors, as well as harmony between the natural environment and the artificial environment to improve the welfare of the community. The welfare of the community may produce a suitable green space system that would provide a variety of ecosystem services [8]. Results of data identification show that all provinces (34) have enacted local regulations of RTRW and only 27 provinces have only enacted RZWP3K.

The Provincial Spatial Plan is an operational policy plan of the National spatial planning which contains a strategy for provincial development, through optimization of resource utilization, synchronization of sector development, coordination across districts / cities and sectors, and division of roles and functions of districts / cities in regional development. overall. The Regency / City Spatial
Planning General Plan is the elaboration of the Provincial RTRW into policies and strategies for the development of district / city areas that are following their functions and roles in the overall provincial regional development plan. This regional development strategy is the basis for the preparation of a spatial plan.

The importance of spatial planning because spatial planning serves as a spatial model to integrate and see the harmonization of development plans. The RTRW map includes maps of spatial patterns, spatial structures, and strategic areas, identification of the RTRW and is shown in Table 2.

**Table 2. Identification of regulated substance for RTRW and RZWP3K maps**

| Province       | Spatial Pattern            | Strategic Area                                                                 | Public Use Area                  | Regulated substance of RZWP3K Maps                |
|----------------|---------------------------|------------------------------------------------------------------------------|----------------------------------|--------------------------------------------------|
| Central Java   | Protected Area, Cultivated Area | Urban System, Main Infrastructure System, Energy / Electrical Network Systems, Telecommunication Network System, Water Resources Network System | Economy, Social, Utilization of natural resources and / or high technology, the importance of the function and carrying capacity of the environment | Tourism, Port Capture Fisheries, Aquaculture industry, Public facilities, Mangrove forest National Park | Karunian Area National Park Delivery channel, Submarine cables, Migration of marine life |
| North Sulawesi | Protected Area, Cultivated Area | Urban System, Main Infrastructure System, Energy / Electrical Network Systems, Telecommunication Network System, Water Resources Network System | Economy, Social, Utilization of natural resources and / or high technology, the importance of the function and carrying capacity of the environment | Tourism, Port Capture Fisheries, Aquaculture industry, Public facilities | Coastal and Small Islands Conservation Areas, Maritime Conservation Area, Marine Protected Areas Delivery channel, Submarine cables, Migration of marine life |
| Lampung        | Protected Area, Cultivated Area | Urban System, Main Infrastructure System, Energy / Electrical Network Systems, Water Resources Network System | Economy, Social, the importance of the function and carrying capacity of the environment | Tourism, Port Capture Fisheries, Aquaculture industry, Public facilities, Mining Settlement | Coastal and Small Islands Conservation Areas, Maritime Conservation Area, Marine Protected Areas Delivery channel, Submarine cables, Migration of marine life |
| West Sulawesi  | Protected Area, Cultivated Area | Urban System, Main Infrastructure System, Energy / Electrical Network Systems, Telecommunication Network System, Water Resources Network System, Other Infrastructure Network Systems | Social, Utilization of natural resources and / or high technology, the importance of the function and carrying capacity of the environment | Tourism, Port Capture Fisheries, Aquaculture industry, Public facilities, Mining | Coastal and Small Islands Conservation Areas, Maritime Conservation Area, Marine Protected Areas Delivery channel, Submarine cables, Migration of marine life |
| South Kalimantan | Protected Area, Cultivated Area | Urban System, Main Infrastructure System, Energy / Electrical Network Systems, Water Resources Network System | Social, the importance of the function and carrying capacity of the environment | Tourism, Port Capture Fisheries, Aquaculture industry, Public facilities, Mining National Defence and Security | Coastal and Small Islands Conservation Areas, Maritime Conservation Area, Marine Protected Areas Delivery channel, Submarine cables, Migration of marine life National defence and security, Environmental protection |

(Source: Data Analysis)

The zoning plan for coastal areas and small islands is one of planning for the management of coastal areas and small islands. RZWP3K is a direction for the utilization of resources in coastal areas and small islands for the provincial government or district / city governments. The zoning plan for coastal areas and small islands is a plan that determines the direction of resource use for each planning unit accompanied by the determination of general use areas, certain national strategic areas, sea lanes, etc. in the planning area which contains activities that may be carried out and may not be carried out as well as activities that can only be carried out after obtaining a permit. The identification status of Mapping aspect and another substance between RTRW and RZWP3K are shown in Table 3.

Based on Law no. 27 of 2007 concerning the Management of Coasts and Small Islands which was later amended by Law no. 1/2014, the government and local governments are required to prepare a coastal and small island management plan. In order to realize the goal of spatial planning that is safe, comfortable, productive and sustainable, harmonization between the regional spatial plan or RTRW and the zoning plan for coastal areas and small islands or RZWP3K is something that needs to be done.

The RZWP3K regulatory area based on the agreement of the ministry / agency is a coastal area that was included in the sub-district administration for land areas, as well as marine areas as far as 12 miles from the coastline.
### Table 3. Mapping aspect and another substance characteristic between RTRW and RZWP3K

| Mapping and other technical aspect | RTRW | RZWP3K |
|-----------------------------------|------|--------|
| **Base map**                      | RBI  | RBI dan LPI |
| **Map scale**                     | RTRW Province 1:250,000 | The minimum map scale is 1:250,000 and can be detailed to a scale of 1:50,000 |
|                                   | RTRW Regency 1:50,000   |                                    |
|                                   | RTRW City 1:25,000      |                                    |
| **Satellite data resolution**     | RTRW Prov: minimum 41 m | Variety satellite data from resolution 15 m to 1 km resolution. |
|                                   | RTRW Regency: minimum 8 m |                                      |
|                                   | RTRW City: minimum 4 m  |                                      |
| **Spatial pattern**               | Protected Area, Cultivated Area | Conservation area, Public Use Area (KPU), Specific National Strategic Areas (KSNT), Sea lane none |
| **Spatial structure**             | Infrastructure network, Energy networking, Telecommunication networking, Drinking water network, Drainage network, Water waste network |                                      |
| **Regulator**                     | Ministerial Regulation ATR / BPN N 1 of 2018 concerning guidelines for the preparation of Provincial, District and City RTRW | Minister of Marine Affairs and Fisheries Regulation No. 23/2016 on planning for the management of coastal areas and small islands |
| **Compiler**                      | Spatial Planning Agency: Bappeda / DPUPR at the Provincial, Regency/City level | Provincial Marine and Fisheries Service |
| **Substance approval**            | Ministry of ATR/BPN | Ministry of Marine Affairs and Fisheries |
| **Goal**                          | Spatial planning for land, sea, air and deep earth areas, Sustainable use of the potential of natural resources, human resources, and artificial SD, Synergy in the implementation of cross-sectoral spatial use policies. | Integrated management planning for coastal areas and small islands |
| **User**                          | Community and stakeholders | Community and stakeholders |
| **Period**                        | Valid for 20 years and can be reviewed every 5 years | Valid for 20 years and can be reviewed every 5 years |
| **Data**                          | Base map | Base map |
|                                   | Thematic map | Thematic map |
| **Analysis**                      | Land suitability | suitability: capture fisheries, aquaculture, marine tourism, ports, sea sand mining, coastal agriculture, industrial areas, kind of disaster |
|                                   | Land capability system |                                      |

(Source: Data Analysis)

#### 3.2. Data Integration and synchronization

Integration of the RTRW Map means a process of merging or unifying spatial data including map information on spatial patterns, spatial structures, and strategic areas in each district / city of the six provinces that are used as study locations for this activity.
Integration has been carried out to ensure (1) the similarity of geometric aspects (projection system using a transverse Mercator, geographic coordinate system and datum WGS 1984), (2) topology improvements, to eliminate Undershoot / gap and Overshoot / overlap that occur due to differences in administrative boundaries in districts / neighboring cities, (3) seamless spatial map of all provinces in the study area. Figure 2 is one of the seamless map produce during the integration process.

![Figure 2. A seamless RTRW of Central Java after integration form 17 RTRW of Regency/district](image)

**Table 4.** The finding fact of potential conflict after integration process for study area

| Province        | Number of Integrated District | Finding fact of Spatial Zoning problem                                                        |
|-----------------|-------------------------------|------------------------------------------------------------------------------------------------|
| Central of Java | 17 districts                  | Agriculture dried land with protected forest zones, Water catchment area with settlement zones, Landslide prone area with settlement zones, Production forest with protected forest zones, Fishery area with nature conservation area and cultural heritage zones |
| North Sulawesi  | 13 districts                  | Agriculture with national park zones, Plantation with protected forest zones, Production forest with protected forest zones |
| NTB             | 10 districts                  | Marine and aquatic reserves with limited forest production zones, HPT with protected forest zones, Plantation with protected forest zones, Agriculture area with protected forest zones |
| Lampung         | 7 districts                   | Plantation with national park Bukit Barisan zones, Settlement with river border zones          |
| West Sulawesi   | 5 districts                   | Plantation with protected forest zones, Wildlife reserve with limited forest production zones   |
| South Kalimantan| 4 districts                   | Permanent production forest with natural tourist park zones, Forest production with protected forest zones |

The integration process produces a seamless map between adjoining districts / cities at a scale of 1: 250,000. The integration of the Regency / City RTRW map was based on the joining of two contrasting classes, the protected area and the cultivation area. The protected area, based on Law No.26 of 2007 is an area defined with the main function of protecting the preservation of the living environment which includes natural and artificial resources. While the cultivation area is an area that is determined with the
main function to be cultivated based on the conditions and potential of natural resources, human resources, and artificial resources

The finding fact of potential conflict after integration process for study area, as for the conflict area, this research showed the potential conflict in some areas, especially in protected (conservation areas) zone with cultivation and public use zones, and between the cultivation areas, fisheries, industries, tourist area with protected forest. Other findings are on the technical aspect, which shows the differences in the coastal area due to the use of two different coastlines. The land spatial planning (RTRW) uses Rupabumi map (RBI) while the coastal water spatial zonation plan (RZWP3K) uses the Indonesian coastal map (LPI). Regarding substance, there are differences in the content of the framework of the RTRW and RZWP3K mandates in regional regulation, in particular the absence of provisions regarding the spatial structure and spatial patterns as mandated in the marine spatial planning law.

The integration of RTRW and RZWP3K can generally be divided into 4 categories, namely (1) Mutual benefit between existing zones, (2) giving each other negative impacts, (3) disconnection is not interrelated and (4) cannot be exposed and unknown the impact. Some examples of integration and synchronization results are presented in Figures 3a, 3b, 3c and 3d. A comprehensive understanding of these relationships are needed so that a spatial planning system could result in harmony environment between two adjacent land use zones.

Identification of the results of the integration of the district RTRW on adjacent zones / sub-zones that have the potential for conflict, including:

a. Protected / Conservation Areas with Cultivation / Public Use.

b. Between Cultivation Areas / Public Use: Fishery / Agriculture and Industry.

c. Plantation, limited forest production, agriculture, a settlement with protected forest

Identification of integration and synchronization of the RTRW and RZWP3K on adjacent zone/subzone that has the potential conflict occurred in the area as follows: A. Public area such as tourist, mining, fisheries, aquaculture and industry zones, B. Conservation Area in RZWP3K doesn’t have a clear area in adjacent areas in RTRW or doesn’t have a regulation, C. Specific National strategic Area, D. marine lanes such as pipe and cable, shipping lanes showed has not connected to the network transportation in the island at RTRW. Results of synchronization in general showed that the directions for land utilization in RTRW (the spatial pattern and spatial structure) has a lot of inconsistencies with the directions for zoning utilization in the RZWP3K. The summaries of synchronization between RTRW and RZWP3K for the entire study area is shown in Table 5.

A tourism zone adjacent to a nature reserve (protected area) in Grabang District, Ngombol District, and Purworejo District (Purworejo Regency) province of East Java

Figure 3a. Synchronization between RTRW and RZWP3K in East Java for tourist area
The mangrove forest zone is adjacent to an industrial area in Demak Regency.

The submarine pipeline network in Genuk District, Central Java Province does not describe the network in its land area.

Figure 3b. Synchronization between RTRW and RZWP3K for submarine pipeline.

Figure 3c. Synchronization between RTRW and RZWP3K for mangrove and industrial areas.

The port intersects the migration path of the biota in Cilacap Regency.

Figure 3d. Synchronization between RTRW and RZWP3K for migration of biota.
### Table 5. Summary of Integration and Synchronization result RTRW and RZWP3K

| Location | RZWP3K | RTRW | Location |
|----------|--------|------|----------|
| A. Public Area | | | |
| 1. Tourism zone | Protected area (forest, national park, Mangrove, area prone to disaster and fault) | 6 Provinces |
| | Industry | C. Java and S. Kalimantan |
| 2. Port Zona | Special terminals and several ferry ports Not Regulated in RTRW; Differences in Harbour Order, the location of the port is not the same | Lampung |
| | Protected area (forest, national park, Mangrove, area prone to disaster and fault) | S. Kalimantan |
| 3. Mining Zone | | | |
| 4. Fisheries Zone | Marine Protected Area | Lampung |
| 5. Aquaculture Zone | Protected area (forest, national park, Mangrove, area prone to disaster and fault), Industry | C. Java |
| 6. Zona Industry | Protected area (Nature Reserve, Nature Conservation, Geological Protection) | Lampung, S. Kalimantan, N. Sulawesi |
| B. Conservation Area | | | |
| Coastal and Small Islands | Not regulated | Lampung, S. Kalimantan, W. Sulawesi, NTB |
| Conservation Areas Marine Conservation Area Marine Protected area | | N. Sulawesi |
| Mangrove Conservation Area | Not regulated | Central Java, South Kalimantan, West Sulawesi, NTB, Lampung and North Sulawesi. |
| C. Specific National Strategic Area (SNSA) | | | |
| SNSA Military training | Not regulated | Lampung, C. Java, NTB, S. Kalimantan, N. Sulawesi |
| SNSA Outer Islands | | | |
| SNSA Others | | | |
| D. Marine Lanes | | | |
| Pipe and cables | Not connected to the network on land | Lampung, C. Java, S. Kalimantan, N. Sulawesi, W. Sulawesi |
| Shipping lanes | Not connected to port system and not connected to road transportation | | |
| Marine Biota | Meet with Shipping lanes or Underwater Pipes | Lampung, S. Kalimantan, N. Sulawesi, W. Sulawesi |
| Migration lanes | | | |
4. Conclusion

The integration of the RTRW map and the RZWP3 map showed several findings that help to identify an adjacent land use management to avoid conflicts in land use planning. The identification of maps for RTRW and RZWP3K found that the reference base map of these two maps were different which affects the difference of coastline. The differences include the geometric, attribute, and topological aspects of the dataset. As for the geometric aspect, the land spatial planning (RTRW) adopts rupabumi map (RBI) as a base map while the coastal spatial plan (RZWP3K) uses the Indonesian coastal map (LPI). Through the GIS technique, the geometric difference between the two maps can be overcome or edited. There are still inconsistencies found in adjacent zonation between RTRW and RZWP3K, therefore to achieve the Sustainable Coastal Area Development goal, harmonization between the regional spatial plan or RTRW with the coastal and small islands plan or RZWP3K should need to be done before implementing the national development program.

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References

[1] Hasyim, F., Subagyo, H., Darmawan, M. 2016. One map policy (OMP) implementation strategy to accelerate mapping of regional spatial planning (RTRW) in Indonesia. IOP Conference Series: Earth and Environmental Science, 2016, 37(1), 012054. Doi: https://iopscience.iop.org/article/10.1088/1755-1315/37/1/012054

[2] Bappenas 2015. Kajian penyusunan materi teknis Pedoman Singkronisasi rencana tata ruang dan rencana Pembangunan

[3] BIG. 2017. Presentasi Pemetaan Integrasi Tata Ruang Wilayah dan RZWP3K. Laporan Project 2017.

[4] Franto, 2020. Metode pemetaan potensi mineralisasi limbah primer dengan penginderaan jauh dan sistem informasi geospasial. Scopindo Media Utama. Surabaya

[5] Arif Zainul Fuad, Aida sartimbul, Feni Iرانawati, Abu bakar Sambah, Defri Yona, Nurin Hidayati, Ledhyana Ika, Julinda Sari, Arif Rahman. 2019. Metode Penelitian Kelautan dan Perikanan: Prinsip Dasar Penelitian, Pengambilan sample, analisis dan Interpretasi data, Universitas Brawijaya (UB) Press Malang

[6] Holdstock, D.A, 2017. Strategic GIS Planning and Management in Local Government. Published December 11, 2019 by CRC Press Taylor & Francis Group. New York

[7] Rohmat. 2019. Geography. Tim Ganesha Operation. Penerbit Duta. Bandung

[8] Liyun Yang, Linbo Zhang, Yuan Li, Songtoo Wu. 2015. Water Related Ecosystem Services Provided by Urban Green Space: A case Study in Yixing City (China). Landscape and Urban Planning. 136: 40 - 51.

[9] Missaka H., Tiffany H Manson, Deephii Wickramsing, Ranjith Mapa, Aijith De Alwis, Olive A McAlpine. 2015. The Eco-sosial Transformation of Urban Wetland : A case study of Colombo Srilanka. Landscape and urban Planning. 132: 55-68.