

The Strategy of Badan Informasi Geospasial For Indonesia's Geospasial Infrastructure Information Development

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ABSTRACT

Indonesia's national development needs geospatial information (GI) as a guidance. The existing GI can be implemented well if Indonesia has better geospatial information infrastructure (GII). The GII dimensions are policies, institutions, technology, standards and human resources (HR). However, the GI produced across sectors still experiences overlap. This study uses the literature study method and using the comparative analysis method to comparing policies in Indonesia with several countries. This study provides policy options for the Badan Informasi Geospasial to prepare a comprehensive study of the condition of GII in Indonesia relating to state institutions, inventory the existing conditions of the five dimensions of GII in all agencies, carry out an inventory of policies and standards that will cover, and create a road map for HR training and technology for organizing GI, and carry out concrete cooperation and training with government agencies that still inadequate in implementing GI and developing GII.

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A. INTRODUCTION

Geospatial information (GI) is needed to support national development. Geospatial information itself is the content of a database collected from geographic facts (Longley et al., 2015). GI is geospatial data that has been processed, and GI is spatial information on the earth's surface or what we often call a map. GI implementation can be carried out well if it has good spatial data infrastructure (SDI). The concept of SDI was born long time ago. Based on Phillips et al. (1999), SDI consists of technology, data, communication, standards and procedures, and cooperation that disseminates spatial data via electronic networks or not. Later Rajabifard (2008) defines SDI as a dynamic, hierarchical, and multidisciplinary concept. The dimensions in SDI are society, data, network access, institutional policies, technical standards, and human resources (HR).

This regulation defines National SDI as technology, policies, criteria, standards, and employees for sharing and publishing geospatial data. The Indonesian government itself has adapted the SDI concept as geospatial information infrastructure (GII) in Law Number 4 of 2011 about Geospatial

Information (GI Law) and Government Regulation Number 45 of 2021 concerning the Implementation of Geospatial Information

The concept of SDI has been implemented in various countries around the world. For example, the United States has the Geospatial Data Act of 2018. This regulation defines National SDI as technology, policies, criteria, standards, and employees for sharing and publishing geospatial data. The Indonesian government itself has adapted the IDS concept as geospatial information infrastructure (GII) in Law Number 4 of 2011 about Geospatial Information (*Undang-Undang Nomor 4 Tahun 2011 Tentang Informasi Geospasial*) (GI Law) and Government Regulation 45/2021 about the Management of Geospatial Information (*Peraturan Pemerintah Nomor 45 Tahun 2021 Tentang Penyelenggaraan Informasi Geospasial*).

The GI Law and Government Regulation 45/2021 state that GII comprises policies, institutions, technology, standards, and human resources dimensions. Government Regulation 45/2021 defines the policies dimension as national and government agencies GI policies. Institutions are defined as a forum for administering GI. Technology is a means that supports the implementation of GI by technical criteria. Standards are references and guidances such as Indonesian national standards (SNI) and other technical specifications. Human resources are certified professionals whose capacity has been increased through education, training, or research.

Since the GI Law was born, GII implementation has been implemented. However, there are still many GI production problems. Kementerian Koordinator Bidang Perekonomian (The Coordinating Ministry for Economic Affairs) (2020) explains that in 2020, geospatial information between government sectors in Indonesia will overlap with 77.4 million hectares (40.6%) of Indonesia's land area. From this report, the reason for the high percentage of data overlap is the lack of GII capacity owned by government agencies, such as the lack of human resources who have GII competency, there are differences in references/standards held by each agency, there are various portals for sharing geospatial data and information that owned, as well as the lack of policies and institutions regarding the implementation of geospatial information for each agency.

BIG does not have vertical agencies, so it needs a national geospatial information network (Jaringan Informasi Geospasial Nasional/JIGN) to ensure that the implementation of IG in central and regional agencies can be run by statutory mandates. According to Presidential Regulation 27/2014 about the National Geospatial Information Network (*Peraturan Presiden Nomor 27 Tahun 2014 Tentang Jaringan Informasi Geospasial Nasional*), government agencies appointed to become network nodes are responsible for administering GI in their agencies. Due to differences in the situation and conditions of GII in government agencies, the implementation of IG needs to be optimal, which needs attention. Therefore, the research question of this study is: what is the GII development strategy in Indonesia carried out by the Geospatial Information Agency? This study aims to find a policy strategy for developing Indonesia's GII.

Several theories related to this study are public policy theory, geospatial data, and geospatial data infrastructure. According to Cairney (2020), public policy results from government action, which begins with intention and is realized in the final results. Public policy has a policy cycle with a flow of agenda-setting, formulation, determination, implementation, evaluation, and maintenance (Cairney, 2020). Geospatial data results from raw geographic data collection, while geospatial information is geospatial data that has been processed (Longley et al., 2015).

This study examines how the policy challenges for developing geospatial information infrastructure in Indonesia are seen through the perspective of Spatial Data Infrastructure (SDI) theory. The SDI theory used is from Rajabifard (2008), which is adapted to the dimensions contained in the GI Law and Government Regulation 45/2021 to explain the root problems of GII in Indonesia. According to Rajabifard (2008), a dynamic, hierarchical, and multidisciplinary concept included in SDI are the dimensions of society, data, network access, institutional policies, technical standards, and human resources. If the SDI runs well, data management will run well too. However, in its implementation, each country has its policies and challenges regarding the dimensions of SDI. Several researcher has researched about the challenges of in many countries such as Mozambique (Atumane & Cabral, 2019),

Iran (Kalantari Oskouei et al., 2019), India (Singh, 2009), Croatia (Ciceli et al., 2014), American countries (Gómez et al., 2019). This differences between this article with another articles is about the research object (Indonesia) and the using of comparative research. This study aims to can increase the knowledge of government agency to improve the quality of their GII to make a better GI.

B. METHOD

This study uses literature research by conducting policy comparisons to explore the similarities and differences between SDI/GII policy challenges in Indonesia and similar policies in several countries. The public policy comparison method uses the concept of Doods (2013) to obtain input on SDI or GII development policies in Indonesia. The public policy comparison method from Doods (2013). Doods (2013) defines public policy comparison as using a comparative approach to investigate policy cycles, outputs, and impacts. Comparing public policies between countries can increase knowledge about domestic and foreign policy developments. Comparisons can be made across different countries, countries belonging to multinational groups, regions within a country, members of organizational classes, policy sectors, and periods. This study describes about Indonesian GII and then compares the conditions and challenges of SDI in several countries such as Mozambique, Iran, India, Croatia, and American countries based on SDI dimensions. After that, similarities and differences between the challenges and recommendations from all articles are analyzed. Lastly, then then strategy recommendations for BIG are made.

C. RESEARCH FINDING AND DISCUSSION

Indonesia is an archipelagic country (17,504 islands) with a land area of 1,900,000 km² (Kementerian Koordinator Bidang Kemaritiman, 2018). Because Indonesia is so vast, more effort is needed to organize geospatial information (mapping). The Coordinating Ministry for Economic Affairs (2020) explained that there are still many mapping errors, so there is overlapping data (40.6% of land area) between government sectors, which is proof that the implementation of GI in Indonesia is less than optimal due to the poor condition of SDI/GII in Indonesia. Of the five GII dimensions contained in GI Law, the following problems can be identified.

a. Policy dimension

Currently, several regulations have been established regarding the implementation of IG, such as the Presidential Regulation on the One Map Policy (*Kebijakan Satu Peta/OMP* in Presidential Regulation 9/2016 (Perpres 9/2016) and Presidential Regulation 23/2021 (Perpres 23/2021)), Indonesian One Data (IOD in Presidential Regulation 39/2019 (Perpres 39/2019)), dan JIGN in Presidential Regulation 27/2014. This policy is used as a reference in preparing action plans that are carried out through IG national coordination meetings or other forums in accordance with statutory regulations. Data was obtained from the National GI Network Node Performance Monitoring Information System page or Simojang (Badan Informasi Geospasial, 2022d). For example, of the 34 provinces that have been assessed, there are 24 provinces that still need to form all/part of the required derivative policies regarding GI development in their regions.

b. Institutional dimension

The GI institution has been mandated in writing in the GI Law, Presidential Regulations on IOD, OMP, and JIGN with the formation of Data Trustees/Network Node Liaisons, Data Guardians/Network Nodes, Data Producers/National Thematic Geospatial Information (TGI) Working Group. However, because of the many regulations governing it, there is confusion among implementers in these institutions. For example, the institution of the Geospatial Information Agency (BIG) is as follows.

- In Presidential Regulation 27/2014, BIG acts as a connecting network node that connects network nodes throughout Indonesia and as its own network node, which has an IG production and dissemination unit.

- In Presidential Regulation 39/2019, BIG plays the role of central-level geospatial data developer and has units as producers and data custodians of base maps.
- In OMP, BIG acts as head of the KSP implementation team, and there is a unit that is the data guardian, as well as the TGI national working group.

However, of the many positions held by BIG, there is no role for BIG as a coordinator to coordinate institutional stakeholders in implementing the national IG. In the KSP and SDI Presidential Decree, BIG appears as the implementing institution that supplies data and guides IG organizers regarding data.

c. Technology dimension

The existence of an agency portal is essential in making it easier to share data that is integrated into the national portal. Based on data from the Badan Informasi Geospasial (2022d), of the 574 government agency portals, there are 238 agencies connected to the national geoportal, 38 agencies are disconnected, and 298 agencies still need to be connected. This is because many regions still need to get technology according to the specifications provided, and there is a lack of knowledge from government agencies regarding the implementation of GI and GII. This is a severe problem because adequate technology is needed to ensure the smooth sharing of data. Apart from that, due to several IG implementation regulations, there are several national portals, such as Inageoportal, OMP portal, and IOD portal, which also confuse users.

d. Standard dimension

As of 2022, BIG has produced 115 SNIs (Badan Standardisasi Nasional, 2022) and 22 other technical specifications (Badan Informasi Geospasial, 2022b) in legal products. Most existing standards are standard procedures for collecting and processing GI, and some are standards for managing and disseminating GI adopted from ISO. The large number of standards causes problems such as confusion from producers and data guardians because there are related standards.

e. Human resources dimension

Currently, Indonesia has 1,536 certified professional geospatial information human resources (Badan Informasi Geospasial, 2022c). Apart from that, a Functional Position (JF) for Mapping Surveyors has been established in government agencies, which are competent in administering national GI. As of September 2022, there are 807 JF Mapping Surveyor government staff (*Aparatur Sipil Negara/ASN*) with details of 46 district/city government ASNs, 48 ASNs in provincial governments (including provincial/district/city agencies), 375 BIG ASNs, and 338 ASNs in central agencies other than BIG (Badan Informasi Geospasial, 2022a). Judging from the hundreds of districts/cities in Indonesia, the number of district/city ASNs alone is problematic because they only have 46 people who have the competence to administering GI.

Various countries have implemented SDI, such as Mozambique, Iran, India, Croatia, and countries on the American continent, as listed in Table 1. These countries were chosen because they have implemented SDI and are located on different continents. Table 1 discusses SDI challenges from other countries and recommendations from several scientific literature articles that can be considered for adaptation to SDI problems in Indonesia.

Table 1.

Conditions and Challenges of SDI in Several Countries

| Country | SDI Dimensions | SDI Challenges |
|-------------------------|---|--|
| Mozambique ¹ | Organizational framework, legal framework, technical framework, and accessibility | Lack of awareness of the importance of SDI. There are no regulations regarding the management of spatial data. Different experiences between institutions: <ul style="list-style-type: none"> • Three institutions do not have data-sharing procedures. |

| Country | SDI Dimensions | SDI Challenges |
|---------------------------------|---|--|
| | | <ul style="list-style-type: none"> • The standards used are still different between institutions. • There are still unclear mechanisms. |
| Iran ² | Organization, HR, information, financial resources, and technology | Awareness of the importance of SDI is still lacking. The condition of SDI in Iran is still not advanced. The cause is the lack of organizational development, human resources, and information. |
| India ³ | Data, policies and institutions, technology, stakeholders, improving socio-technical networks | The challenges in India are institutions that are unwilling to change, a lack of knowledge about the importance of SDI, and technical, organizational, and financial challenges. |
| Croatia ⁴ | Technology, measurement, standards, regulatory implementation, services, HR, and other factors that influence data management and dissemination | SDI implementation in Croatia is good. They just need to pay attention to several points in the future, such as quality assurance, use, usefulness, and funding. |
| American countries ⁵ | Institutions, human resources, norms, standards, and geographical information, technology, and budget | In several countries, there are problems such as: <ul style="list-style-type: none"> • There is no SDI institution yet, so it isn't easy to produce geospatial data. • Lack of HR knowledge. • The sharing mechanism is still not completed. • d. Many countries do not yet have national standards for organizing geospatial information. |

Sources: ¹Atumane & Cabral (2019), ²Kalantari Oskouei et al. (2019), ³Singh (2009), ⁴Ciceli et al. (2014), ⁵Gómez et al. (2019)

Analysis of problems or challenges in GII development in Indonesia is compared with challenges from several countries in Table 1. Similarities and differences are identified. The similarity is that various problems from all dimensions exist in the development of GII.

1. The institutional problem is that BIG, as an institution that has duties and functions in organizing GI, needs more influence and power to coordinate so that the implementation of national GI can run well. The resulting GI can be beneficial for national development. The same problem is faced by Mozambique, Iran, India and several countries in America.
2. Differences in human resource knowledge and the need for more competent human resources in the field of GI implementation at each institution. Iran and several countries in America face the same problem.
3. Knowledge and awareness of the importance of SDI/GII in the regions still need to be improved. The same problems faced by Mozambique, Iran and India.
4. Situations and conditions in different government agencies result in technology use problems. Mozambique, Iran, India and several countries in America face the same problem.

However, some problems are unique to Indonesia; when other countries lack policies, institutions, standards, and national portals, Indonesia instead has so many national regulations, roles in institutions (the same assignment because many regulations have different terms), GI technical standards, and national sharing portals result in potential overlap and can confuse users. From the policies that several countries have implemented, it can be concluded that there are various kinds of solutions that can be taken, as listed in Table 2.

Table 2.
Recommendations for IDS Development in various countries

| Country | Recommendation |
|---------------------------------|--|
| Mozambique ¹ | There is a need to form a steering committee to initiate joint agreements between stakeholders in implementing SDI |
| Iran ² | SDI needs to be placed in a powerful institution, and the awareness of all stakeholders regarding SDI needs to be increased, and financial security for SDI needs to be built. |
| India ³ | Increased stakeholder collaboration, user-based SDI implementation, and data and portal development. |
| Croatia ⁴ | Croatia has good policies and a strong governance structure to coordinate and manage SDI stakeholders. |
| American countries ⁵ | There needs to be a formal SDI policy |

Sources: ¹Atumane & Cabral (2019), ²Kalantari Oskouei et al. (2019), ³Singh (2009), ⁴Ciceli et al. (2014), ⁵Gómez et al. (2019)

Based on the various root causes as explained and several similarities with other countries, here are several policy options that can be offered, as follows.

- State institutions need to increase BIG power in organizing GI so that it can be easier to collaborate and coordinate all central and regional government agencies and increase awareness of the importance of GII development in Indonesia, as in several countries in Table 1 and Table 2.
- If point a can be implemented, BIG can more easily increase awareness of the need for competent human resources for GI organizers to increase the quality and quantity of human resources for organizing GI. Improving the quality of human resources, as in American countries, can be done by providing training to the personnel concerned. Increasing the quantity of JF Mapping Surveyors can be done by transferring from another position, so there is no need to carry out large-scale recruitment. Transfers from other positions can be carried out because there are 1,027,425 civil servants who are not JF or Structural Positions (Badan Pusat Statistik, 2021). Requirements for transfer from another position are adjusted to the regulations.
- Due to the many existing policies and standards, BIG needs to harmonize and map standard requirements. If two or more policies and standards are the same, simplification may be considered. BIG can simplify by deregulating policies or abolishing SNI so that this simplification will result in simplifying various overlapping portals and institutional terms. However, the sign that needs to be remembered is that there needs to be an in-depth study of deregulation or abolition. The hope of simplifying policies and standards is that it will be easier for users to get trusted GI from the government.

Government agencies that organize GI need to prepare a job analysis and workload analysis regarding the needs of JF Surveyor Mapping in their agency as well as a suitable human resource development mechanism. Apart from that, it is necessary to adjust funding related to increasing technological capacity according to the responsibilities and needs of implementing GI by the limitations in the applicable regulations.

D. CONCLUSION AND RECOMMENDATION

Conclusion

The Geospatial Information Agency (BIG), as the agency in charge of organizing GI, needs to develop three strategies for developing GII. The first strategy is to prepare a comprehensive study of the condition of GII in Indonesia aimed at state institutions to provide information on the importance of BIG's role if appointed as coordinator in implementing national GI. The second strategy is to inventory the existing conditions of the five dimensions of GII in all agencies, carry out an inventory of policies and standards that BIG will simplify, and create a road map for developing human resources

and technology for implementing GI. The third strategy is to provide concrete cooperation and guidance to government agencies that still need to be more optimal in implementing GI and developing GII.

Recommendation

This research focuses on BIG as the agency responsible for geospatial information. Besides BIG, there are also many government agencies that produce GI with another theme based on the regulation. Therefore, there is a need for research regarding GII in another agencies. So, the quality of all Indonesian GI will continue increase to support the national development.

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