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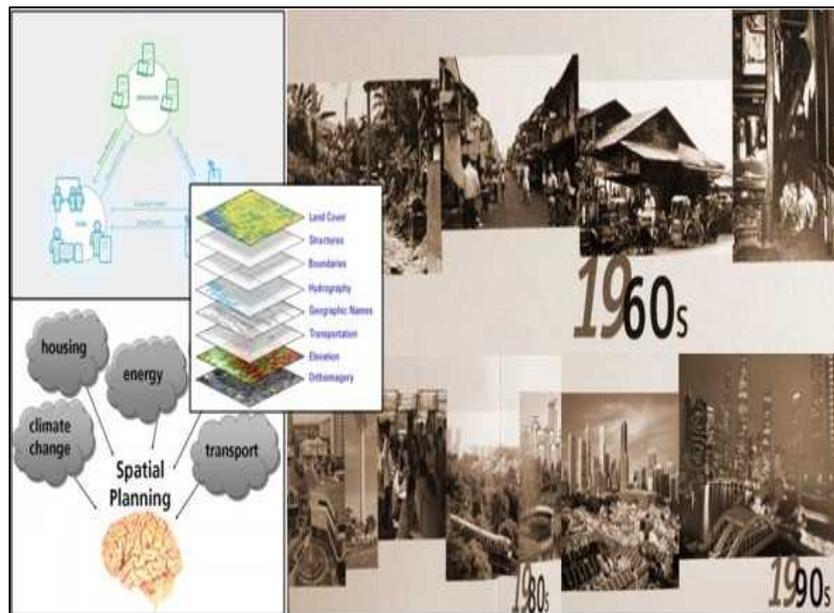
Thesis Report GIRS-2012-03

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**The Use of Spatial Data Infrastructure  
In Spatial Planning In Indonesia**  
*(A Case study in DI Yogyakarta, Central Java and East Java)*

Decki Rahadian Firdiansyah

March 27<sup>th</sup> 2012



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*(A Case study in DI Yogyakarta, Central Java and East Java)*

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A thesis submitted in partial fulfillment of the degree of Master of Science  
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The Netherlands.

27<sup>th</sup> March 2012

Wageningen, The Netherlands

Thesis code number: GRS-80436  
Thesis report: GIRS-2012-03  
Wageningen University and Research Centre  
Laboratory of Geo-Information Science and Remote Sensing

## **Foreword**

This report is written to partially fulfill the requirements of Master in Geo-Information Science at Wageningen University. I have been working for Ministry of Public Works since 2006. Since then, I learned that spatial planning is very interesting. One of the duties of Ministry of Public Works is to assist the local government in spatial planning arrangements. Currently, only 10 of 33 provinces in Indonesia have been established their spatial planning although the spatial planning regulation that compels all level of the local governments has been issued in 2007. Spatial planning formulation is not a one-day project forcing local government to make a lot of efforts for it. One of the obstacles faced by the local government is the provision of spatial data. The spatial data is very specific and has to be relevant to the requirements of spatial planning. On the other hand, spatial data infrastructures (SDI) may offer local government the needed spatial data. The access network, policy and standard which are some of SDI components may play a role in the provision of spatial data for local planning through SDI. This research focuses on the use of SDI including its components in supporting spatial planning in Indonesia.

## **Acknowledgements**

First of all, I would like to thank to God for His blessing that gave me strength in the accomplishment of my thesis on time. Although most of my research was done at home using my laptop, I shall thank to Arnold Bregt and Lukasz Grus for every precious time they share in the discussions I had. The discussions were very valuable and always gave me hints or ideas to solve my problems. I had to thank to Arnold for his concern in the earlier stage of my thesis completion.

I also want to thank to all my fellow master students and my Indonesian colleagues who had given a spirit each other not only for the thesis completion, but also for the completion of the study. They made me realize that I was not alone, but together I might give a spirit each other. A little help in daily life would also be a valuable thing for me who had to adapt with a new life, culture and education system. I should also appreciate Mr. Suryaman Kardiat who gave me names that can be contacted to be the interviewees of this research.

Last but not least, I shall thank to my parents and by beloved wife for their support. Her support had kept me focus on my study. Also, I shall thank to my parents who always pray for the success and safety of their children everyday.

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## **Abstract**

Spatial planning arrangements in Indonesia have incorporated cross-sector stakeholders and people. The arrangements require a new approach to embrace all stakeholders and formulate spatial planning. On the other hand, Spatial Data Infrastructure (SDI) is considered as a new instrument that provides a communication channel for people to share and use spatial data. The data are then used to formulate spatial planning policy. This paper proposes the potential use of SDI in supporting spatial planning in Indonesia. Results of the observation among related scientific literature and in-depth interviews in research areas were used to determine an appropriate method to measure the use of SDI in spatial planning and summarize the use of SDI in spatial planning in Indonesia. It was concluded that the use of SDI in supporting spatial planning in Indonesia needs to be optimized. Only 3 (three) SDI components (policy, standards and people) support spatial planning arrangements in Indonesia. Therefore, in order to optimize the use of SDI in spatial planning, the government of Indonesia should pay more attention on the development of access network. The communication channel between the local government and SDI networks shall also be improved to facilitate SDI networks in providing more relevant spatial data needed for spatial planning and increasing the awareness of the local government to SDI concepts.

**Keywords:** spatial data infrastructure, spatial planning, local spatial data network, Indonesia

## **1. Introduction**

Nowadays, spatial planning has shifted from traditional land use planning into integrated planning approach incorporating land use policy with other policies and programs (Cada et al., 2010). Current spatial planning connects many stakeholders and may deploy particular spatial data and technology. Therefore, the implementation of spatial planning should promote cross-sector synergy and cross-region approach amongst every tier of the government, society and private sector.

Spatial planning process in Indonesia, as the case study of this project, is a form of top-down process (MILT Japan, 2011). A plan at a lower tier must not conflict with the one at the higher level. The input data, which is the spatial data used by every tier of administration, can be considered as a challenge since there will be an opportunity of data duplication and inappropriate use of spatial data. This circumstance might happen if every level of government collects and uses data by itself without validating the data to the higher level of administration.

On the other hand, Spatial Data Infrastructure (SDI) proposes data sharing and data integration which is necessary for spatial planning formulation through the arrangement of policies, people, organizations, and technology (Sutanta et al., 2009). SDI enables various users to access, retrieve, and distribute spatial data resources effectively (Putra, 2010). The development of SDI may bring spin-off effect where its users are facilitated in terms of sharing and dissemination of data. Furthermore, SDI can help decision-makers, such as planners, in formulating a policy.

This thesis investigates the use of Spatial Data Infrastructure (SDI) in supporting spatial planning in Indonesia. The current chapter presents the problem, objective and structure of the thesis.

### **1.1. Problem definition**

SDI development can be dedicated for a particular purpose (Grus, 2010). For instance, the specific goals of the INSPIRE directive is to generate an SDI that can support the policy makers in managing the environment (European Commission, 2007 cited in Grus, 2010). In the case of this study, SDI should support the provision of general and detailed spatial plan. The existence and management of SDI would maintain the presence of spatial data which is important for general and detailed spatial plan. Recently, the endorsement of Geo-spatial Information Act No. 4 of 2011 tries to revitalize the SDI in supporting the spatial planning. One of the purposes is to give the provincial and local governments as well as The Ministry of Public Works wide access, ease of use and share of spatial data and information that hold the key role of general and detailed spatial plan. Consequently, the provincial and local governments may increase their awareness about the benefit of SDI (Puntodewo and Nataprawira, 2007).

Given the benefits and objectives of the SDI, the assessment of SDI use, especially its role in supporting spatial planning would be interesting to do. Currently, no research has been done for assessing the use of SDI in supporting spatial planning in Indonesia. The assessment of the use of SDI may provide information that can be used to identify the relationship of the organization involved and the effectiveness of SDI for a specific field especially spatial planning.

Since I realize that the assessment of SDI use might be complex in reality, it is necessary to limit the research. This research only considers the role of spatial data in the process of spatial planning. The research does not take into account the impacts of the SDI within the spatial planning process since they are difficult to measure. Hence, this research measures the use of

SDI in supporting spatial planning in Indonesia. The depth of the research is to examine the role of SDI in the formulation of general and detailed spatial plan in 3 (three) provinces and 3 (three) city/regencies under the selected provinces (table 1).

**Table 1. Research areas**

| No. | Region's Name        | Scope             | Province's Name      |
|-----|----------------------|-------------------|----------------------|
| 1.  | <b>Jawa Tengah</b>   | <b>Province</b>   | <b>Central Java</b>  |
| 2.  | Semarang             | City/Kota         | Central Java         |
| 3.  | <b>Jawa Timur</b>    | <b>Province</b>   | <b>East Java</b>     |
| 4.  | Bangkalan            | City/Kota         | East Java            |
| 5.  | <b>DI Yogyakarta</b> | <b>Province</b>   | <b>DI Yogyakarta</b> |
| 6.  | Sleman               | Regency/Kabupaten | DI Yogyakarta        |

In Indonesia, indeed most of spatial data is already available. However, only a few researches regarding the use of Spatial Data Infrastructure in supporting the spatial planning has been done. The SDI of Indonesia, which maybe also the same problem in other countries, is still isolated in practice leaving its tasks and obligations to the authorized institution. So far, the development of SDI is only limited to the improvement of cooperation between organizations responsible in the geo-information field and spatial planning policy which has not touched another problems, such as data, standards, network access and policy. Nevertheless, how to make spatial data infrastructure as spatial planning support system that may assist the decision maker in determining a proper plan? Starting from that question, this project is trying to investigate the use of SDIs in supporting the spatial planning policy in Indonesia.

## 1.2. Research objective and research questions

Based on the problem definition discussed above, the main objective of this research is to assess the use of Spatial Data Infrastructure (SDI) in supporting spatial planning in Indonesia.

I use case studies of 3 (three) provinces and 3 (three) city/regencies under the selected provinces as illustrated by table 1. These provinces and regencies have already passed a local government rule enacting general and detailed spatial plan as ordered by Spatial Planning Act No. 26 of 2007. I select regencies under the responsibility of the observed provinces as the case studies as well in order to find out whether the local government policy in the different level is the same. Further, I use the term "local government" to refer to these provinces or regencies.

The following research questions are defined to attain the main objective:

1. How to assess the use of SDI in supporting spatial planning?
2. What is the use of SDI in supporting spatial planning in Indonesia?

Two main research domains are revealed from these questions: spatial planning and SDI. The implementation of SDI policies and concepts in Indonesia has already been long a topic of discussion, but the potential use of SDI in supporting spatial planning, especially in Indonesia, has not been unraveled by previous research. The main focus of this research is therefore on evaluating the relationship between SDI and spatial planning in Indonesia.

## 1.3. Thesis' structure

This thesis is structured in accordance with research questions raised in the preceding section. Sources of information for this study consist of existing documentation about Indonesia SDIs;

government rules about local planning context, methods, and data requirements; and field surveys with local planners in the selected case of study.

The subsequent chapters are explained as follows. Chapter 2, the theoretical background, explains the current circumstances of SDI and spatial planning in Indonesia. First, the present condition of SDI in Indonesia is described briefly. Second, the current state of spatial planning in Indonesia is exposed. The types of spatial data that should be gathered by the local government in the making of general and detailed spatial plan according to the government regulation is also described. In addition, I would talk about the role of spatial data in supporting local planning according to literature review.

Chapter 3 provides the research design and methodology to answer the research questions. The research design is presented earlier. Then, the methodology of each research question will be explained step-by-step.

The results of the field work are presented in Chapter 4 and 5. Chapter 4 will present the results of the first research question, while chapter 5 will address the second research question. Each variable of the selected method depicting the use of SDI in spatial planning in Indonesia is presented in chapter 5.

In Chapter 6, three interesting remarks found during the fieldwork are discussed. There are 3 (three) remarks that will be explained. First, the importance of spatial information by the central government agencies will be conferred. Second, the development of local spatial data network will be discussed. Third, the role of Bakosurtanal will be presented.

Chapter 7 addressed profoundly the results in conjunction with the theory presented in the previous chapter. This section thereby also provides the answers to the research questions. The final assessment of the use of SDI in spatial planning in Indonesia will be provided in this chapter.

Chapter 8, which is the last chapter, presents some recommendations to address the issues that have been discussed in previous chapter. These suggestions can be carried out by the local governments and Bakosurtanal.

## **2. Theoretical Background**

I shall describe briefly the extent, definition and description of SDI and spatial planning in Indonesia to link both domains. This chapter also presents the concepts in SDI and spatial planning and supplies a basis for the next chapter. To begin with, a current condition and development phase of SDI in Indonesia shall be illustrated. Next, I shall describe the current state of spatial planning in Indonesia. Afterwards, I explain the function of spatial data in supporting local planning including the requirement of spatial data in the making of general and detailed spatial plan according to the government regulation and literature review.

### **2.1. Indonesia's Spatial Data Infrastructure**

The government of Indonesia faces a number of problems in providing adequate access to spatial data. The main issues impeding the development of Indonesia's SDI are data duplication, low data quality, poor management and low participation of stakeholders (Matindas et al., 2004). The government through Badan Koordinasi Survey dan Pemetaan Nasional (Bakosurtanal) or National Coordinating Agency for Surveying and Mapping has already made some efforts to manage these issues by taking several actions.

First, in order to support the development of national spatial data infrastructure, the government issued Presidential Decree No.85 of 2007 that regulates national spatial data networks. According to this law, Bakosurtanal acts as a network node center integrating any spatial data collected and managed by the network node bureaus. Bakosurtanal is the coordinator of the Indonesia's SDI on cooperation with other agencies. Several government agencies have been mandated to be network node bureaus by the government. One of them is Ministry of Public Works who is responsible for collecting, maintaining, updating, exchanging, and disseminating spatial data related to highway networks, hydrology, buildings, watershed, waste installation, and spatial planning. Each network node bureau has a clearing unit. Each clearing unit disseminates spatial data or metadata to the community and submits the metadata to network node center.

Second, Bakosurtanal has formulated the development of the infrastructure in some stages. Bakosurtanal started developing Indonesia's Spatial Data Infrastructure (ISDI) in 2000 by implementing internet technology in GIS. Ministry of Public Works played a role by introducing the first on-line mapping of 1:1,000,000 under its website in 2000. Bakosurtanal also developed ISDI nodes, agency databases and metadata, and sets of mechanisms and standards in 2004 (ibid). Previously, Bakosurtanal published three guidelines of ISDI which are ISDI Guidelines, Clearinghouse Handbook, and Custodian Data and Spatial Information Guidelines in 2003.

In order to actualize the published guidelines, the National Geospatial Data Clearinghouse was developed by Bakosurtanal in 2007. The clearinghouse was developed based on the conceptual model and prototype development. The prototype consists of data directory, metadata, and Z39.50 protocol application (Puntodewo and Nataprawira, 2007). The clearinghouse was established as a distributed database server system linking data producer, user, and manager that can be accessed through the internet (ibid). The standard metadata, to which all data producers in Indonesia shall refer, was adopted from Federal Geographic Data Committee metadata standard. Within the clearinghouse, a number of metadata servers are interconnected configuring network nodes. Bakosurtanal also operates a metadata gateway server that allows connection amongst each node.

The metadata database in the metadata server was generated using Geo Profile and Z39.50 protocol (Puntodewo and Nataprawira, 2007). The metadata gateway stores the registry of all node servers. Bakosurtanal also creates a “search engine” using Z39.50 protocol for searching and retrieving process in the internet (ibid).

The National Geospatial Data Clearinghouse is managed by three organizations representing all stakeholders involved (ibid). The organizations are Permanent Committee, National Metadata Gateway, and Geospatial Metadata Center. Permanent Committee directs and manages the continuation of National Geospatial Data Clearinghouse, whereas the National Metadata Gateway maintains and runs metadata gateway. The Geospatial Metadata Center, on the other hand, administers the metadata server within each institution.

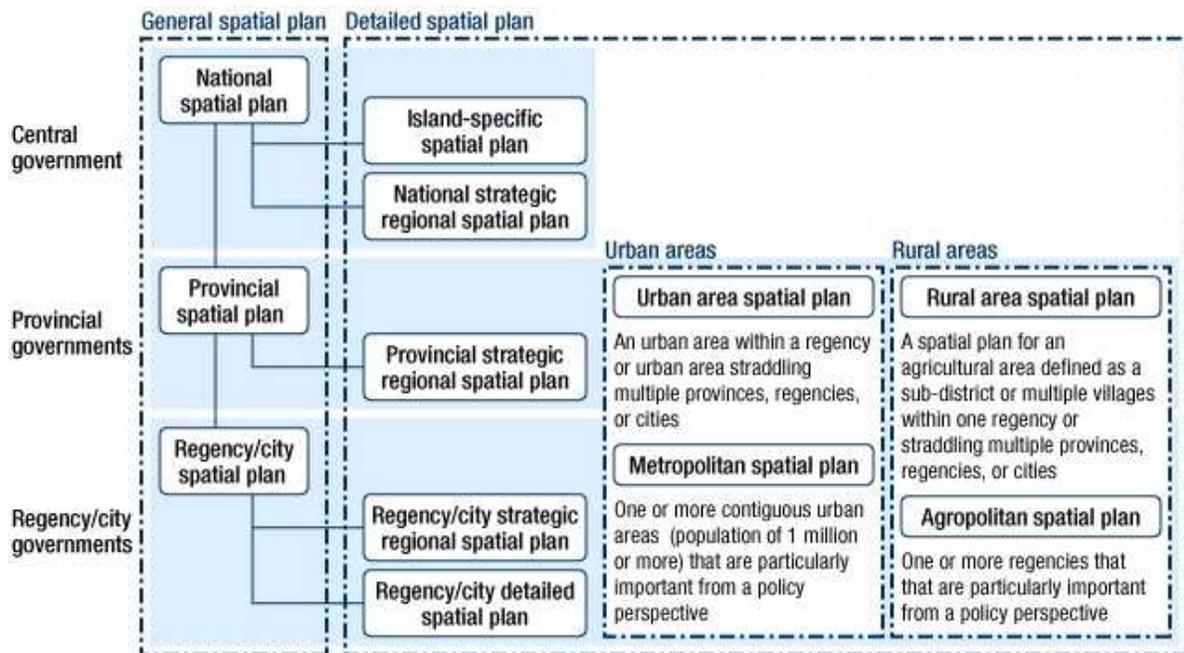
Recently, the ratification of Geo-spatial Information Act No. 4 of 2011 by the parliament recently is expected to trigger the development of Indonesia’s Spatial Data Infrastructure. This new regulation is dedicated to embrace all SDI’s components, such as people, policy, access network, standards and data (Rajabifard et al., 2001; Feeney et al., 2001; Rajabifard and Williamson, 2001; Grus et al., 2010). According to this rule, the stakeholder may participate more in collecting, processing, storing, disseminating, and utilizing geo-spatial information. In this term, private parties not only act as passive users, but also play a role as proactive users in any geo-spatial activities within the framework and restrictions regulated by the law.

## **2.2. Spatial planning policy in Indonesia**

Spatial planning policy in Indonesia can be classified as statutory planning. Statutory planning is the planning system arranged and specified by law (Davidson, 1996). Spatial planning is planning of the layout, utilization and servicing of land. Nonetheless, the local governments in Indonesia are given considerable freedom in the extent and form of their plan. For example, the local governments may determine the form of zoning plans based on their research as long as the zoning plans conform to higher regulation.

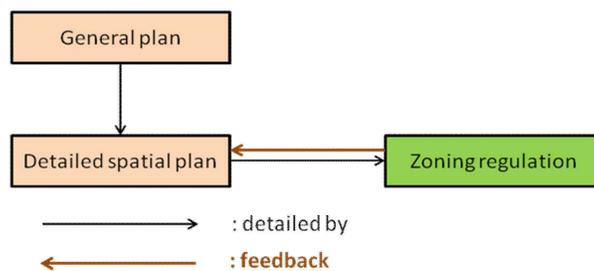
Spatial planning policy in Indonesia, as the case of study of this project, has undergone changes in recent decades. Dating back to 1992, spatial planning policy in Indonesia was first set by the enactment of Spatial Planning Act No. 24 of 1992. The regulation was later amended by Spatial Planning Act No. 26 of 2007, which handles issues of national spatial planning for a 20 year-period, but is to be evaluated every five years (Spatial Planning Act 2007, c.6). The organization in charge for setting of spatial planning policy is Badan Koordinasi Penataan Ruang Nasional (BKPRN) or National Spatial Planning Coordination Board chaired by Coordinating Minister for Economic Affairs. Technical implementation of spatial planning policy is submitted to the Directorate General of Spatial Planning of the Ministry of Public Works including the handling of real-world problems.

Indonesia’s spatial planning policy is implemented to achieve national territorial space that is safe, comfortable, productive, and sustainable (Djakapermana, 2007). The basis of the policy is environmental harmony, integration of natural resources, and protection against negative environmental impact due to utilization of space. Therefore, the government built a strategic framework to create a national spatial planning program. The strategic framework is embodied in the detailed spatial plan that includes several levels as shown by figure 1.



**Figure 1. Indonesia's Spatial Planning Policy**  
(Source: MILT Japan, 2011)

Spatial Planning Act No. 26 of 2007 compels every level of government to set a general plan and a detailed spatial plan of their region. The general spatial plan is decomposed into, at least, a detailed spatial plan. The detailed spatial plan, on the other hand, is arranged based on regional strategic value approaches with local substances that include land use and allocation of zones. It is then referred by the zoning regulation for controlling space utilization (figure 2). The detailed spatial plan and zoning regulation are illustrated into a thematic map that contains the distribution of allocation blocks (zones) with specific rules for each block. The map also describes land use and its location. Zoning regulation has zoning statements describes land use and area, permitted and conditional uses, minimum lot requirements, development standards, and zoning development administration. The detailed spatial plan and zoning regulation have to be informed to the community to reduce conflicts and negative impact of the utilization of space and guarantee the development of an efficient, effective and appropriate functions of the city and consistent with the spatial planning policy.



**Figure 2. Relationship between spatial planning and zoning regulation**

### 2.3. Spatial planning arrangements process

According to Government Regulation No. 15 of 2010 about spatial planning arrangements, the spatial planning procedure of city or regency comprises 7 (seven) stages:

1. The preparative stage which is the preliminary phase to encompass public ideas;
2. The proposition of draft of spatial plan regulation by the Major or Regent to city/regency council;
3. The Governor's recommendation to the draft meaning that the content of the draft conform to the spatial plan provincial regulation;
4. The draft will be brought to BKPRN meeting to be discussed deeply. The meeting which is also attended by Bakosurtanal and Ministry of Public Works is usually conducted regularly every 3 (three) months. After the meeting, the draft should be substantially approved by the Minister of Public Works;
5. The mutual consent of draft of spatial plan regulation by the Major or Regent with the city/regency council;
6. The Governor evaluates the draft of spatial plan regulation. The results will be returned to the City or Regency;
7. The enactment of spatial plan regulation by the Major or Regent.

The schematic view of spatial plan in Indonesia can be seen in Figure 3.

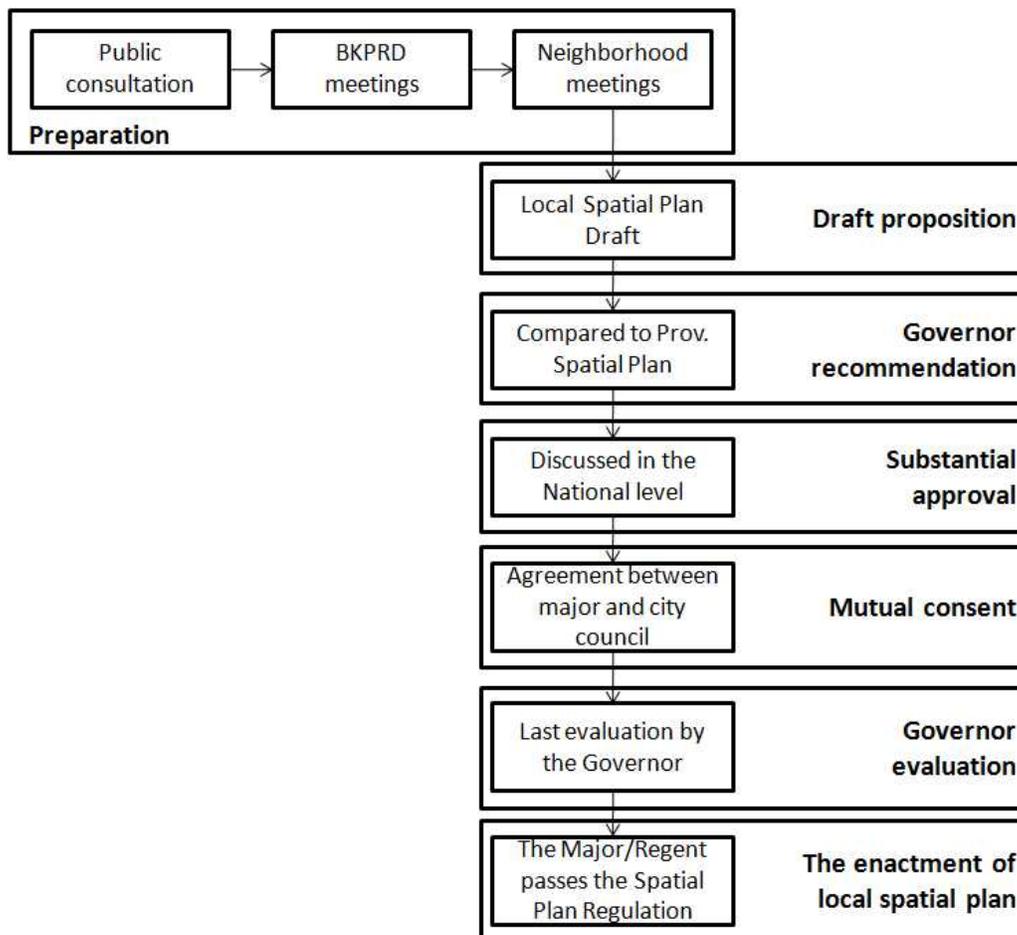


Figure 3. Schematic overview of spatial planning in Indonesia

The procedure of spatial planning arrangements of the province is more or less the same as that of the City or Regency. The different is that the one who propose the draft is the Governor. The draft is submitted to the province council and should also have the Minister of Public Works' substantial approval. Prior to the enactment of spatial plan regulation of province, the Minister of Domestic Affairs evaluates the draft of spatial plan regulation.

The preparative stage can be broken down into 3 (three) stages. First, the local government invites public, such as the academia, NGOs, community's leader, etc., to gather any required information. Second, Badan Koordinasi Penataan Ruang Daerah (BKPRD) or Local Spatial Planning Coordination Agency discusses the preliminary findings with the Major or Regent. The information and ideas from the public will be conferred and put into the local planning draft. Third, the Major or Regent invites neighborhood(s) Major or Regent and neighborhood(s) BKPRD to communicate the local planning draft. In every stage of the preparative stage the local government always presents their spatial analysis findings to the audiences.

#### **2.4. The role of information for spatial planning**

Spatial planning is recognized as a multidisciplinary science that incorporates multi sector stakeholders and multi dynamic resources. Current spatial planning relates to many stakeholders, methods, inputs, outputs, technologies, tools, etc. Therefore, the implementation of spatial planning should promote cross-sector synergy and cross-region approach amongst every tier of the government, society and private sector. Thus, a comprehensive research coupled with cooperation, communication and standardization is the essential requirement of the upcoming development of spatial planning (Cada et al., 2010).

Nedovic-Budic (2000) claims that planning is a future-oriented activity with the following goals:

- improved quality of urban environments;
- environmentally and socially sustainable societies;
- effective spatial organization of urban activities;
- well-organized communication channel between various urban functions;
- recovery of slump areas;
- offers various of housing choices;
- employment opportunities and economic development; and
- democratization of the planning and policy-making process.

Planning policy and its decision-making processes are dependent on accurate localized information and on deeper comprehension of the broader communities' problems and trends (Nedovic-Budic et al., 2004). Therefore, planners and/or authorities conduct extensive data gathering, diffusion, analysis, and presentation activities on a daily basis to support their works.

Moreover, planning is an "applied science" for reaching desired goals by determining problems, recognizing goals, creating alternatives, and assessing available alternatives regarding selected goals (Klosterman, 1997, p.6). Computerized information technology has been used as a tool for collecting, storing, and retrieving necessary data providing models of real life conditions and serving the users to support all planning functions, the intelligence function in particular (Harris and Batty, 1993 cited in Klosterman, 1997, p.7; Nedovic-Budic et al., 2004).

Spatial planning processes require spatial data as an input to generate the expected goals. For example, spatial data in the form of base map with sufficient scale where spatial plan will be set out. The availability of base maps, which is not a big problem in the recent decennia, may

support the activities of policy makers and planners in determining the direction of spatial planning policy. The provision of base maps for the entire territory of Indonesia which is coordinated by the National Coordinating Agency for Surveying and Mapping (Bakosurtanal) (Puntodewo and Nataprawira, 2007), is a strategic program and expected to support the spatial planning policy as mandated by Government Regulation No. 10 of 2000, both at national, provincial, district, or city. Furthermore the existence of the base map will also be beneficial in terms of utilization and also control the utilization of space.

Nedovic-Budic et al. (2004) summarizes common data requirements for local planning which is similar to the data requirements mandated by Government Regulation No. 15 of 2010. The common data requirements are shown by table 2.

**Table 2. Common data requirements for local planning**

| Type                    | Content  |
|-------------------------|--|
| Population              | Totals; by gender; by race; by ethnicity; by education   |
| Housing                 | Number of dwelling units; by dwelling type; by quality; vacancies; supply and demand   |
| Transportation          | Roads by capacity and use; traffic counts; public transportation; rail lines; bus lines; airports; private own cars  |
| Economics               | Household income; employment rate; unemployment; poverty; commercial volume; industrial production   |
| Utilities               | Water; electricity; natural gas; sewage/storm drainage; solid waste; telephone; radio; TV  |
| Facilities and Services | Libraries; recreation centers and activities; schools; day care centers; hospitals   |
| Health and safety       | Police stations; crime statistics; fire stations   |
| Environment             | Topography by elevation, slope, and exposure; soil types; water bodies; floodplain; air quality; water quality; hazards by incidence and location; ecosystems/natural habitats |
| Land                    | Property cadastre and titles; property assessed value; land use, land ownership; land supply/demand; development potential   |
| Urban development       | Buildings; development permits and application status; aerial photography  |
| Plans and policies      | Master/comprehensive plans; zoning and subdivision ordinances; capital improvement programs and budgeting; emergency preparedness and hazard mitigation; building codes; etc.  |

**Sources: Branch (1981); Dandekar (1988); Kaiser et al. (1995) summarized by Nedovic-Budic et al. (2004)**

For that matter the central government passed Government Regulation No. 15 of 2010 in 2010 in order to give a guideline for local governments in the making of a general plan and a detailed spatial plan. This regulation also tends to standardize the minimum data requirements in the arrangements of the general and detailed spatial plan. According to this rule the minimum data requirements in the arrangements of general and detailed spatial plan are:

- administrative area;
- physical geography;
- population;
- economic and financial;
- infrastructure and basic facilities;
- land use;
- allotment of space;
- disaster-prone areas; and
- topographical base maps and other considerable thematic maps.

Another interesting issue from the Government Regulation No. 10 of 2000 is the use of national geographic information system for any mapping activities entailed by spatial planning. By developing an integrated network system, the provision of territory map is not expected to be a problem in spatial planning.

Regarding the issues discussed above, Indonesia has vast set of spatial data as a result of many activities of survey and mapping covering almost of the national territory (Matindas et al., 2004), but the data are gathered, managed and then stored locally. It causes spatial data and metadata generated by the agencies are not fit to the national standard set by Bakosurtanal. Although this circumstance gives an opportunity for the local planners to retrieve the required data, it also reserves a room for SDI to offer such a communication channel of data retrieving and sharing as mandated by Government Regulation No. 10 of 2000.

Additionally, according to the Presidential Decree No.85 of 2007 there are 14 (fourteen) ministries/national agencies which together configure national SDI networks (table 3). These ministries/agencies are also supported by local government agencies which shape local spatial data networks. Those data above (table 2) are potentially offered by national SDI networks and local spatial data networks for spatial planning arrangements. The national agencies/ministries, mentioned in the second column of table 3, are responsible for collecting, maintaining, updating, exchanging and publishing spatial data related to certain field, cited in the first column of table 3.

**Table 3. National Spatial Data Networks**

| <b>Field</b>                    | <b>National Spatial Data Networks</b>                 |
|---------------------------------|---|
| Survey and mapping              | Bakosurtanal  |
| Land/cadastre                   | BPN (National Land and Cadastre Agency)               |
| Internal affairs                | Ministry of Internal Affairs                          |
| Transportation                  | Ministry of Transportation                            |
| Communication and Informatics   | Ministry of Communication and Informatics             |
| Public Works                    | Ministry of Public Works                              |
| Culture and Tourism             | Ministry of Culture and Tourism                       |
| Statistics                      | BPS (Statistics Central Agency)                       |
| Energy and Mineral Resources    | Ministry of Energy and Mineral Resources              |
| Forestry                        | Ministry of Forestry                                  |
| Agriculture                     | Ministry of Agriculture                               |
| Marine and Fishery Affairs      | Ministry of Marine and Fishery Affairs                |
| Meteorology and Geophysics      | BMKG (Climatology, Meteorology and Geophysics Agency) |
| Outer Space and Aviation Agency | LAPAN (National Outer Space and Aviation Agency)      |

Maps used in spatial planning using different scales according to the spatial plan that is being formulated. The accuracy level of maps for spatial plan is determined based on minimal scale which is required to reconstruct any information on the map as stipulated by Government Regulation No. 10 of 2000 (table 4). Currently, the scale accuracy for required spatial data in spatial plan formulation is being revised. The enactment of new regulation about scale accuracy however is still put on hold.

**Table 4. Scale for maps required in spatial plan formulation**

| <b>Scope</b> | <b>Maximum Scale</b> | <b>Minimum Scale</b> |
|--------------|----------------------|----------------------|
| National     | 1 : 1.000.000        | 1 : 1.000.000        |
| Province     | 1 : 250.000          | 1 : 50.000           |
| Regency      | 1 : 100.000          | 1 : 25.000           |
| City         | 1 : 50.000           | 1 : 10.000           |

Phillips, Williamson and Ezigbalike (1999) and Nedovic-Budic et al. (2004) assert that SDIs can potentially benefit to local urban planning by:

- reducing cost and data duplication;
- giving such standardization, tools and guidelines for data production;
- facilitating data integration more simply and quickly;
- assisting the process of analysis, plan and policy development, and administration of urban development within and between jurisdictions;
- providing a communication channel which may address planning problems and ideas;
- supplying for more informed decision-making;
- providing means of networking and referencing various data sources;
- ensuring consistency and compatibility of data development across administrative and organizational bound; and
- increasing occasions for program investments and marketing of local amenities and competitive advantages.

The exchange and sharing of spatial data amongst stakeholders in the society is one of the aims of Spatial Data Infrastructure (SDI) (Phillips, Williamson and Ezigbalike, 1999; Rajabifard et al., 2001; Feeney et al., 2001; Rajabifard and Williamson, 2001; Crompvoets et al., 2008; Cada et al., 2010). The current world and public need to share, combine, search, distribute and publish spatial data related to spatial planning (Cada et al., 2010). SDI facilitates data sharing and data integration which is necessary for spatial planning formulation through the arrangement of policies, people, organizations, and technology (Sutanta et al., 2009). For that reason, SDI have the potential to provide better service to decision makers, politicians, and communities (Masser et al., 2007; Grus, 2010).

Having said and done, I further inquire about the use of SDIs in Indonesia to fulfill such information required by spatial planning process. The following section discusses the methodology and the results of the findings in the field.

### 3. Research Flowchart and Methodology

This chapter describes the research design and methodology. The research design is illustrated in advance. Through the research design, the reader can have a look the details accomplished during the research. The methodology is explained later for each research question. The methodology shows step-by-step of action carried out to address the research questions.

#### 3.1. Research flowchart

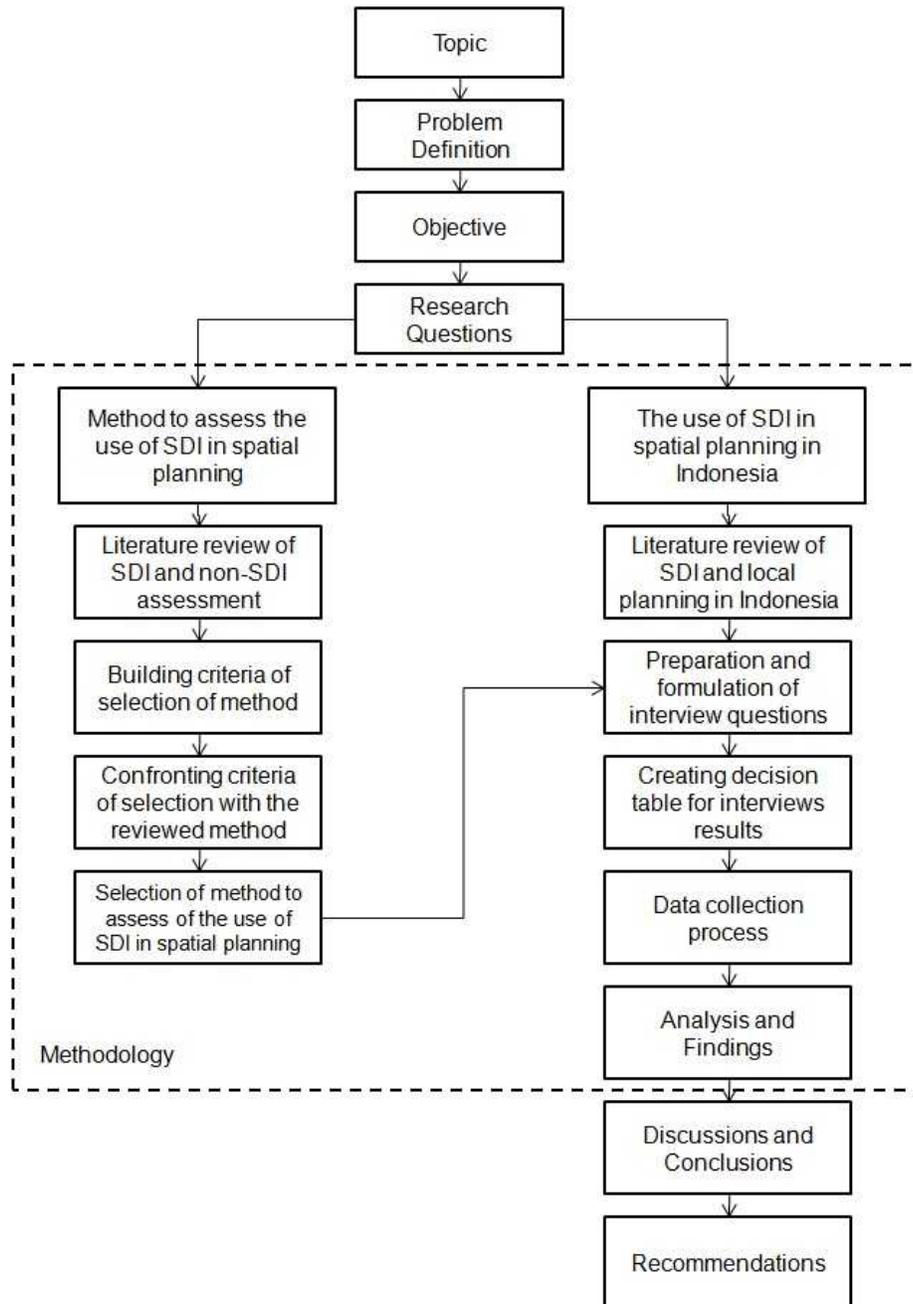


Figure 4. Research flowchart

The research can be broken down into several stages as shown in figure 4. Starting from selection of a topic for the research, it ends up with recommendations that can be taken into account by the authorities. After defining the problem, the research objective and questions are determined. Then, the methodology to address the research questions is constructed. Later, the discussions and conclusions are settled on. Lastly, the recommendations are made to address the interesting remarks that are found during the research.

### **3.2. Methodology**

To address the research questions, a set of methodology is developed. In next sub-chapter, the methodology for each research question is explained. To refresh the reader's mind of the research questions, the research questions shall be written again in bold italic sentences. The methodology is described in each paragraph following each research question below.

#### ***How to assess the use of SDI in supporting spatial planning?***

The first thing to do to answer the first research question is to conduct literature reviews. I shall review some assessment methods that potentially to be used for the research. There are many sources of information that can be picked for assessing SDI. However, to be in line with the research topic several assessment methods from three domains are investigated: SDI, use of information and spatial planning in conjunction with SDI.

Afterwards, indicators that are used to provide specific information about the use of SDI in supporting spatial planning in Indonesia shall be defined. After performing literature reviews, indicators of each method can be previewed. Those indicators will be evaluated based on a set of criteria of selection. Briefly, a set of criteria of selection needs to be constructed so that we can evaluate those indicators prior to measure and gather the information properly and correctly.

The indicators are assessed by using certain criteria of selection. Indicators are important in order to make the process of survey convenient (Mayoux, 2001). Indicators often play an important role in any studies or researches since it will indicate specific information needed by the researcher. Oxford English Online Dictionary defines an indicator as:

*'a device providing specific information on the state or condition of something'*

Mayoux (2001) claims that there is no a perfect set of indicators for assessing something. Indicators however may provide a range of possible signs, symptoms or hints by which impacts can be observed, measured or detected with varying degrees of certainty. Some examples of a set of criteria for assessing indicators are SMART and SPICED indicators (World Health Organization, 2000; Mayoux, 2001; Giff, 2008).

The next step is to confront potential methods that have been reviewed against the criteria of selection. Each method shall be assessed and graded against the developed criteria. The grade shall also be defined. To simplify the process of assessment, a comparison matrix can be drawn. Each method is placed in each row of the matrix, whereas the criteria of selection are put in each column of the first row.

The last step to address the first research question is to select the appropriate method to assess the use of SDI in spatial planning. Using the comparison matrix, we might choose the method that has the greatest value for each criterion. If there is no method satisfying the criteria,

I shall adjust one of the methods or create a new one. The result is an assessment method of assessing the use of SDI in spatial planning to answer the second research question.

### ***What is the use of SDI in supporting spatial planning in Indonesia?***

There are 5 (five) steps that shall be done to investigate the use of SDI in supporting spatial planning in Indonesia. First, literature reviews of SDI and local planning in Indonesia shall be carried out. Second, fieldwork preparation and formulation of interview questions are done. Third, before doing the fieldwork decision rules to process and analyze the interviews results are created. Then, data collection process through in-depth interviews is conducted. Lastly, I shall analyze the results and gather some interesting findings.

Literature reviews are conducted to provide secondary data. There are 2 (two) kinds of literature that are reviewed. First, government regulations in Indonesia concerning SDI and spatial planning are investigated. This kind of literature is usually published by Ministry of State through NCASM and Ministry of Public Works and easily collected since they can be obtained from the internet. Second, journals and proceedings discussing SDI and spatial planning in Indonesia published by scientists and government officers are explored.

Next, I shall prepare and formulate the interview questions. Taking into consideration the resources that I have (time, efforts and money), in-depth interview is conducted. In-depth interview may also suggest an exploratory study (LTDI, 1999), which may provide the extent of the use of SDI in spatial planning in Indonesia. Before doing the fieldwork, the interviewee candidates are asked their willingness to be interviewed. The interviewees are the people who involve in the arrangements of spatial planning in the research areas. A triangulation method shall be applied by interviewing government officers in the management level and government officers that are functioned as operational staffs. This method is also amplified by interviewing government agencies that are under the same hierarchy within the same jurisdiction. For example, Sleman City is under jurisdiction of the province of DI Yogyakarta. Therefore, we might compare 2 (two) different views or answers. Briefly, the information gathered from the people in management level would provide a hint whether the use of SDI affects the decision making. Additionally, I shall interview people in the operational level, i.e. staff of local planning agencies, so that their awareness and attitudes to SDIs can also be examined. By collecting data from two sources, the information can be compared and the information will be free of bias. Thus, the reliability and the validity of the research can be obtained.

Further, a decision table to handle the interviews results is built. The responses of the interviewees are processed and classified into semi-structured answers that have been built earlier. Each question belongs to a particular sub-indicator, while each sub-indicator is the part of a certain indicator. Each indicator consists of 2-3 sub-indicators. After quantifying the answers, the result of every sub-indicator can be obtained. The result of each indicator depends on the results of its sub-indicators. To simplify in obtaining the indicator result, a clear decision table has to be made.

The interviewees are asked by using a draft of interview questions. These questions are made based on the indicators of the selected method. Some potential answers by the interviewees are included in the draft of interview. The potential answers need to be supplied in case the interviewee asks for those to respond the questions. The answers are consists of 3 (three) possibilities, usually high, medium and low, since this research uses those classes to conclude the use of SDI in spatial planning in Indonesia. If the interviewees give different responses, the

interviewees will be confirmed again and asked which potential answer is closely matched to their responses.

The interviews can be conducted in 2 (two) ways. First, a draft of interview is given to the interviewee beforehand if the interviewee asks for it. Second, the interviewee is not given the draft of interview so they do not know the questions that will be raised to them. The interviews is done in 1 (one) month. For this research, at least 2 (two) people that are responsible in managerial level and operational staff of local planning government agencies shall be interviewed.

Small observations are also done to complement the interview results. Beforehand, I shall ask the interviewees' permit to do small observations in their office. Several things that are observed are: the software used daily by the interviewees to work, the spatial data conditions and the database server. Therefore, I shall ask the interviewees to show their spatial data and working space.

The last step is to analyze the results and findings. The results of the interviews can be extracted using the decision table that has been made previously. Afterwards, interesting remarks can be explored from the explanation of the interviewees during the interviews. The interesting remarks shall be discussed later on.

## **4. Method to Assess of the Use of SDI in Spatial Planning**

This chapter answers the first research questions. First, literature review of methods potentially to be used for assessing the use of SDI in spatial planning is presented. Literature review in three domains was done: SDI, use of information and spatial planning. Then, the criteria for selecting the most appropriate assessment method are discussed. Finally, I shall present the method which conforms to the criteria of selection.

### **4.1. Literature reviews of potential methods**

Several literature from 3 (three) domains; SDI, use of information and spatial planning; are reviewed. Each literature from each domain will be discussed below. Summary of potential assessment methods is shown by table 5.

#### **4.1.1. SDI assessment**

Kok and van Loenen (2005) offer an assessment of SDI based on organizational (institutional) approach. They use a set of concepts developed by Boonstra (2004) to evaluate the success of an NSDI (National SDI). According to the Boonstra's theory, there are 4 (four) stages of development of an NSDI: stand alone, exchange, intermediary and the network stage. Using the case study method, their approach draws an attention to 4 (four) organization components of the SDI: leadership, vision, communication channels and self-organizing ability. Through developmental indicators of an NSDI, the level of development of an NSDI can be measured (Kok and van Loenen, 2005).

Another approach to evaluate SDI is Performance-Based Management (PBM) technique (Giff, 2006). PBM may facilitate continuous and more efficient assessment of SDI (Giff, 2006). This method designs performance indicators based on specific SDI objectives, which are used to measure the effectiveness, efficiency and reliability of SDI (Grus, Crompvoets & Bregt, 2007). Such metrics called Performance Indicators (PIs) are recommended by Giff (2006) to aid in the assessment process. However, this approach is still a conceptual one and the indicators and methods to calculate them have yet to be developed (Grus, 2010).

Grus (2010) develops a goal oriented SDI assessment view for assessing the extent to which SDI meets its goals. The view is broken down into 4 (four) phases: assessment purpose, assessment approach, application and evaluation. The assessment purpose is to define the intention of the assessment, while the assessment approach is conducted to identify SDI goals; select and match the chosen potential indicators with SDI goals; and formulate a goal-oriented SDI assessment approach. He reveals that SDI goals have to be defined clearly to avoid the problem of selecting commonly agreed assessment indicators and assessing the realization of SDI goals. He also indicates that SDI stakeholders have to be identifiable and approachable since their involvement may increase the user's trust for the evaluator and confidence in the evaluation result.

Harvey and Tulloch (2006) studied the willingness to share amongst the local governments in the US. Taking into account NSDI's data integration pyramid constructed by FGDC, they assume that local governments should have embraced the data sharing concept through NSDI. They consider 6 (six) thematic areas to conduct their research: data sharing and coordination; data distribution; use and role of standards; data sharing agreements and policy; relevance of NSDI concepts and policy; and risks of data sharing. They conducted quantitative surveys and qualitative studies in different states, cities and counties government in 2002. The survey

methodology was done in Minnesota and New Jersey using a combination of direct mailings, faxed surveys, and phone surveys based on a set of questionnaire they built. The study qualitative was carried out within 6 (six) local governments by means of interviews. They present 4 (four) types local-government data sharing arrangements based on several conceptual issues and characteristics (open shop; hub-and-spoke; federation-by-accord; and federation-by-mandate) and then classify their case of study at that time into this typology.

#### **4.1.2. Use of information assessment**

Calkins and Obemeyer (1991) propose taxonomy for investigating the use and value of geographical information which is also aimed to structure the survey and case studies. They presume that information brought by GIS is worth only if it is exploited and influences decisions. The taxonomy they built consists of 24 (twenty four) questions, loosely grouped into 6 (six) categories of relevant questions. The categories are: the use of geographic information; the effectiveness of geographic information use; the benefits of the use of geographic information; the measurement of benefits related to information use; characteristics of geographical data and spatial analysis; and organization characteristics.

DeLone and McLean (1992) suggest the concepts of the use of information in terms of duration, amount, nature and level of use. The authors claim that the outcome of a technology is proportional to its use in maintaining organizational objectives. They link the information impact to individual and organizational effects. Information is considered worthwhile if its use influences decisions and improves the organization performance. A good system may enable better understanding of the decision context and enhance productivity and confidence of the decision makers (DeLone and McLean, 1992)

#### **4.1.3. Spatial planning in conjunction with SDI**

Nedovic-Budic et al. (2004) investigate the utility and the effectiveness of existing SDI to local planning activities in conjunction with the interactions between local, state and national levels. The case study of this research was Victoria, Australia and Illinois, USA. Sources of information for their research are available literature about Australian and USA SDIs; general references about local planning context, methods, and data requirements; and field interviews with local planners and spatial data for planning producers and consumers. They consider several criteria of assessment during their research: awareness; data availability; data accessibility; relevance to local planning and decision-making; ease of data integration; effect on the decision making process; and local cooperation. In their research, they conclude that state level SDIs do not effectively serve local needs.

Dessers et al. (2010) introduce two concepts, the SDI configuration and the SDI performance of a process, to investigate which factors might affect the role of spatial data in a concrete process. The SDI configuration include 5 (five) factors derived from each of 5 (five) disciplinary stream. The SDI configuration factors are then classified into 4 (four) groups: input, throughput, output and context. The SDI performance is characterized in two ways: the SDI performance in the narrow sense (access, use and sharing) and in the broad sense (contribution to sub-process performance). This research uses spatial zoning plans case and gathers the information by way of in-depth interviews in 6 (six) organizations: the cities of Genk, Kortrijk, and Leuven, the province of Limburg and West-Vlaanderen, and the Departemen of Spatial Planning, Housing and Immoveable Heritage (RWO) of the Flemish Government. Based on each criterion for each variables of SDI configuration and SDI performance, they summarize 9 (nine) SDI configuration characteristics which might linked to a high level of overall SDI performance.

**Table 5. Summary of potential assessment methods**

| <b>Source</b>               | <b>Concept</b>                               | <b>Definition</b>   | <b>Indicators/Variables</b>  | <b>Method</b>   |
|-----------------------------|--|---|--|---|
| Kok and van Loenen (2005)   | Organizational (institutional) approach      | Measure SDI development from the organizational perspective   | <ul style="list-style-type: none"> <li>• leadership</li> <li>• vision</li> <li>• communication channels</li> <li>• self-organizing ability</li> </ul>  | Case study  |
| Giff (2006)                 | Performance-based approach                   | Evaluate the effectiveness, the efficiency and the reliability of SDI                                 | relationships between the input vs outputs, output vs outcomes, and outcomes vs impacts)   | Not developed   |
| Grus (2010)                 | Goal oriented based approach                 | Evaluate the effectiveness, the efficiency and the reliability of SDI                                 | selected indicators which meet the goals of SDI  | Workshop, document study, survey  |
| Harvey and Tulloch (2006)   | NSDI's data sharing                          | Measure the extent of data sharing among local governments in response to SDI programmes and policies | <ul style="list-style-type: none"> <li>• data sharing and coordination</li> <li>• data distribution</li> <li>• use and role of standards</li> <li>• data sharing agreements and policy</li> <li>• relevance of NSDI concepts and policy</li> <li>• risks of data sharing</li> </ul>  | Case study, quantitative surveys (questionnaire) and qualitative studies (interviews) |
| Calkins and Obemeyer (1991) | Use and value of geographic information (GI) | Betterment in decision making process through the use of geographic information                       | <ul style="list-style-type: none"> <li>• the use of GI</li> <li>• the effectiveness of GI use</li> <li>• the benefits of the use of GI</li> <li>• the measurement of benefits related to information use</li> <li>• characteristics of geographical data and spatial analysis</li> <li>• organization characteristics</li> </ul> | Survey/questionnaire/interview  |

|                             |  |  |   |  |
|-----------------------------|--|--|---|--|
| DeLone and McLean (1992)    | Use, individual, and organizational effects                          | Measure the duration, amount, nature, and level of use of such information; information value; improvement in organizational performance | <ul style="list-style-type: none"> <li>• information use</li> <li>• user satisfaction</li> <li>• individual and organizational impact</li> </ul>  | Not developed  |
| Nedovic-Budic et al. (2004) | Local urban planning community as the potential beneficiaries of SDI | Investigate the utility and the effectiveness of existing SDI to local planning activities   | <ul style="list-style-type: none"> <li>• awareness</li> <li>• data availability</li> <li>• data accessibility</li> <li>• relevance to local planning and decision-making</li> <li>• ease of data integration</li> <li>• effect on the decision making process</li> <li>• local cooperation</li> </ul>   | Case study, literature about SDIs; general references about local planning context, methods, and data requirements; and field interviews |
| Dessers et al. (2010)       | The SDI configuration and the SDI performance of a process           | Investigate the impact of a process-specific SDI configuration on SDI performance  | <ul style="list-style-type: none"> <li>• input of SDI configuration</li> <li>• throughput of SDI configuration</li> <li>• output and context of SDI configuration</li> <li>• SDI performance in the narrow sense (access, use and sharing)</li> <li>• SDI performance in the broad sense (contribution to sub-process performance)</li> </ul> | Case study, interviews   |

## 4.2. Criteria of selection

Some examples of a set of criteria for assessing indicators are SMART and SPICED indicators (World Health Organization, 2000; Mayoux, 2001; Giff, 2008). For this research, I combine some parts of SMART and SPICED indicators as seen in table 6.

**Table 6. Definition of criteria of selection**

| Properties    | Type of indicators regarding the project's objective | Definition  |
|---------------|--|---|
| Measurable    | General  | Indicators must: <ul style="list-style-type: none"> <li>• be quantifiable in order to facilitate comparison with other data,</li> <li>• have data available to collect</li> </ul> |
| Achievable    |  | Indicators should be practical, achievable and cost-effective to implement within a reasonable time-frame and funds   |
| Relevant      | Specific   | Indicators should represent the project objective and suggest an exploratory study  |
| Subjective    |  | Indicators should subject those I assess. The target groups/informants should be defined clearly and involve local government staffs  |
| Cross-checked |  | Information collected needs to be cross-checked, by comparing different indicators and progress and using different methods and informants  |

The general and specific set criteria of selection are defined. In general, the criteria should be measurable and achievable. On the other hand, these criteria particularly should be relevant, subjective and cross-checked. Each method brought by several authors (table 5) is assessed against these criteria of selection. The major concern of these criteria is the measurable property (Mayoux, 2001). We should state how we will record our findings. If others have done a project successfully or it is theoretically possible, then it should be achievable. A project can be achievable but unrealistic since the one who carry out the project does not have adequate resources to complete the project (targets/source of information, access to the source of information, money and time). The indicators must be relevant to the project objective. Other criteria of selection are subjective and cross-checked.

At first glance, the indicators must be quantifiable in order to enable such comparison with other data (Giff, 2006). To be quantifiable, the data collection method has to be clear. Such interviews; observation; case studies; discourse analysis; media items; focus groups; documents, archives and records review; etc. can be used to gather data (Thomas, 2000; Mack et al., 2005). The most important thing is data should be available. We cannot do any research without data after all.

Next, the indicators should be achievable by the project and cost-effective to implement (Mayoux, 2001; Giff, 2006). We should be able to access the target(s) or the source of information. Later, we must consider our capacity to access and obtain data we need which relates to our financial resources and time-frame.

The indicators should also meet the specific requirements brought by the objective of the project. First, the indicators must be relevant. The objective of this project is to assess the use of SDI in spatial planning in Indonesia so it would be better to search indicators used by any literature discussing the use of SDI in spatial planning. The objective of this project also suggests an exploratory study, which seeks to identify the extent of the use of SDI in spatial planning in Indonesia. Thus, this extent needs to be discovered in the course of the research. Moreover, this project evaluates the use of SDIs in the local governments in Indonesia, especially in 3 (three) provinces and 3 (three) cities/municipalities under the observed provinces. The indicators therefore should clearly define the target groups or informants which involves local government staffs. Finally, the indicators should also be cross-checked, by using different informants and methods.

#### **4.3. Selection of the method**

To select the appropriate method, I evaluate and draw the observed methods in a comparison matrix. I put each method in each row of the matrix, whereas the criteria of selection are placed in each column of the first row. Table 8 shows table matrix of potential methods against criteria of selection.

Each method will be scored ranged from 1 to 4 against the criteria of selection. The score expresses the fitness of each method to this research. Score of 4 means that the method is suitable (very good) to the criterion. Score of 3 also indicates that the method is adequate enough (good) against the criterion. Score of 2 (poor) and 1 (very poor) mean the methods need to be improved to match the criterion.

The objective of this research is to find out the extent of the use of SDI in the process of spatial planning in Indonesia. In this research, the performance of Indonesia's SDI is not measured. Nonetheless, the result of this research may indicate the performance of SDI in serving the community, especially in the field of geo-information.

First, Kok and van Loenen's (2005) method is examined. This method is measurable and achievable enough, although data availability and data accessibility should be more taken into account. In this sense, I have to struggle in finding any literature discussing SDI's leadership and self-organizing ability in Indonesia. In particular, this method uses case study and literature reviews. Thus, I consider this method has been cross-checked. This method however does not match up to two criteria, which are relevant to the research objective of this research and subjective. Obviously Kok and van Loenen's (2005) do not discuss the use of SDI for a specific purpose, such as spatial planning, which is researched by this project. Their research also does not observe local planners who are responsible in spatial planning. Inasmuch as I observe the use of SDI in spatial planning, I have to study about how local planners acquire spatial data to support their work.

Second, I reckon that although Grus (2010) proposes a measurable method, the method needs much more time and expenses to be done. Indeed, this method involves the stakeholders when defining the indicators so that selected indicators would be more objective and meet the goals of SDI. Nevertheless, I have to carry out a workshop to pool the indicators from the stakeholders

which demands a lot of costs and time. In addition, this method is not relevant to our objective since it does not talk about spatial planning. Therefore, regarding those reasons, I exclude this method from our option.

Third, Harvey and Tulloch (2006) examine data sharing arrangements among local governments in the US. The data sharing arrangements are the foundation for all SDI-related data sharing. This method is measurable since the data collection method is clear enough and the data can be collected through in-depth interviews (Harvey and Tulloch, 2006). Harvey and Tulloch (2006) used different informants and methods by carrying out a wide spread of in-depth interviews and questionnaire surveys. The interviews were conducted over 4 (four) states and 9 (nine) local governments (cities) under the administrative of the states, while the surveys were done in Minnesota and New Jersey. Therefore, I consider that this method is subjective to the target groups and cross-checked enough. This method, on the other hand, consumes considerable time and a lot of costs. Additionally, this approach does not match the objective of this project which is to find out the use of SDI in spatial planning. This approach however gives some insight about relevant elements to take into account in building a way to assess the use of SDI in spatial planning.

Fourth, a work by Calkins and Obermeyer (1991) provide us taxonomy for investigating the use and value of geographical information. So far, it has never been implemented so it has to be developed. Despite the fact that it has never been implemented, I still consider that this method is measurable enough since the data collection method is clearly defined and the data is available in Indonesia. Conversely, I do not have any idea about the resources I need and the access to the source of information. Hence, this method is not achievable. This method is also not relevant to our project since it focuses on the use and value of geographical information. The target of the respondents is not clearly defined, i.e. local government, GIS producer, NSDI coordinator, etc. This method also does not give any information about the use of different informants or methods. Therefore, I consider that this method is not cross-checked. Nevertheless, this method may give an input about what indicators that can be gathered to review the use of SDI in spatial planning.

Another method that might be adapted is a method used by Dessers et al. (2010). This research observes the impact of a process-specific SDI configuration on SDI performance. Although this method is measurable, this method is not achievable within the time frame I have. This method was done more than 1 (one) year by doing in-depth interviews over many people in 6 (six) regions in Belgium. The in-depth interviews were addressed to the local government and used different informants or methods. Thus, this method matches up to two criteria, subjective and cross-checked. In addition, viewing spatial zoning plans as a specific process, the research investigates whether the selected factors (input; throughput; output and context) have an impact on the SDI performance of the process. Hence, it analyzes the relation of SDI configuration variables to the overall SDI performance within a process. On the other hand, our project attends to study the extent of the use of SDI in spatial planning disregarding the SDI configuration. Also, our project does not take into account the performance of SDI. Another thing to be considered is that the dependencies between such SDI configuration variables to SDI performance in Dessers et al. (2010) are not clear. As a conclusion, I think that the method of this research is not relevant to our project.

Finally, I observe the method used by Nedovic-Budic et al. (2004). This research is measurable enough although I have to take into account to data availability or the lack of literature observing the use of SDI in spatial planning in Indonesia. Furthermore, this research intends to measure the effectiveness of existing SDI development in serving local planning which is relevant to our

project objective. Nedovic-Budic et al. (2004) used case studies of local governments in 4 (four) cities in Australia and the USA and collected the data through literature review and in-depth interviews with local community planners and other producers and users of spatial data for planning which means that this method meets three criteria, achievable, subjective and cross-checked. Several criteria examined by this research is to assess the relationship of SDI and local planning needs through data products supplied at the national, state, and local level. Hence, the criteria of this research might provide some perception about criteria to consider in assessing the use of SDI in spatial planning in Indonesia.

#### 4.4. The selected method to assess the use of SDI in spatial planning

Despite a reality that there is no a perfect method that can be implemented for this research, I choose the method conducted by Nedovic-Budic et al. (2004) for this research. I also add 2 (two) indicators to assess which are: formal policy and implementation capacity (de Vries, 2006). I put these indicators based on two reasons. First, there is only Government Regulation No. 10 of 2000 that regulates the accuracy level of maps for spatial planning arrangements. The accuracy of use and the approval of spatial data for local planning are coordinated with Bakosurtanal. Currently, there is no other law that regulates data standard, metadata, or even spatial data provision for local planning. Thus, it is interesting to observe the awareness and the opinion of the local government to this regulation. Second, de Vries (2006) finds that at the local level of Indonesia the human resources in geo-information field are scarce and distributed randomly. The human resources also need to be stable for promoting tacit local information infrastructures. Unsynchronized rotation of government employees at local level would undermine human capacity in the local public sector. Therefore, I assume that every level of the government may face a challenge when their human resources are promoted or transferred to another institution. Table 7 displays indicators that will be examined to determine the use of SDI in spatial planning in Indonesia.

**Table 7. Indicators of assessment**

| <b>Indicators</b>                          | <b>Definition</b>  |
|--|--|
| Awareness of SDI                           | The extent to which stakeholders are aware of the existence and usability of SDI and its communication channels.                                       |
| Data availability                          | The content and completeness of spatial datasets provided through national SDI   |
| Data sharing accessibility                 | The accessibility of the spatial datasets (policy, agreements, revenue)  |
| Relevance to local planning                | The suitability/relevance of spatial data in SDI networks toward the needs of local planning practice  |
| Data standard and ease of data integration | The extent to which spatial datasets can be integrated with other data (formats, standards, scales)  |
| The effect on decision making process      | Specific decision-making effects carried by the use of datasets acquired through SDIs  |
| Local cooperation and coordination         | The level of cooperation and coordination between governmental agencies and other organizations regarding data sharing and distribution                |
| Formal policy                              | The regulation(s) governing the use of SDI in spatial planning in Indonesia  |
| Implementation capacity                    | Human resources that handle spatial data within the process of spatial planning in Indonesia, particularly in the arrangement of detailed spatial plan |

**Table 8. Comparison matrix amongst potential methods**

| <b>Source</b>               | <b>Measurable</b> | <b>Achievable</b> | <b>Relevant</b> | <b>Subjective</b> | <b>Cross-checked</b> |
|-----------------------------|-------------------|-------------------|-----------------|-------------------|----------------------|
| Kok and van Loenen (2005)   | 3                 | 3                 | 1               | 2                 | 4                    |
| Grus (2010)                 | 4                 | 2                 | 2               | 4                 | 4                    |
| Harvey and Tulloch (2006)   | 4                 | 2                 | 2               | 4                 | 4                    |
| Calkins and Obemeyer (1991) | 3                 | 1                 | 2               | 2                 | 1                    |
| Nedovic-Budic et al. (2004) | 3                 | 4                 | 4               | 4                 | 4                    |
| Dessers et al. (2010)       | 4                 | 3                 | 2               | 4                 | 4                    |

***NB: 4= Very good; 3= Good; 2= Poor; 1= Very poor***

## 5. The Use of SDI in Spatial Planning in Indonesia

This chapter will explain 2 (two) things. First, a decision table is presented to give a clear explanation about how to value each indicator. Second, the analysis of the interviews results that leads to the use of SDI in the formulation of spatial planning is uncovered. A conclusion about the use of SDI in spatial planning for each indicator is also given. The interview is semi-structured based on questions written in Appendix 1. The interviewees and their organizations are shown by Appendix 3.

There is division of tasks in the formulation of general and detailed spatial plan in the provincial government. General spatial plan is arranged by Badan Perencanaan Pembangunan Daerah/Bappeda (Local Planning Development Agency) while detailed spatial plan is drafted by local agency who is responsible for spatial planning arrangements such as Dinas Cipta Karya dan Tata Ruang (Local Planning and Housing Agency) or Dinas Pekerjaan Umum, Energi, dan Sumber Daya Mineral (Local Agency of Public Works, Energy and Mineral Resources). This circumstance however does not apply to the city/regency authority. Mostly, all spatial plan arrangements are accomplished by Badan Perencanaan Pembangunan Kota/Kabupaten (Bappeko/Bappekab) or City/Regency Planning Development Agency. Both general and detailed spatial plan are the parts of Peraturan Daerah RTRW (Local Regulation of Spatial Plan). Local Planning Development Agency and Local Planning and Housing Agency put the draft of general and detailed spatial plan together in BKPRD meetings prior to formulating Local Regulation of Spatial Plan.

### 5.1. Decision table matrix

This research adopted 9 (nine) indicators displayed by table 7. Each indicator may have 2-3 sub-indicators. The value of sub-indicators is one of 3 (three) distinct values; high, medium and low; of which represents the degree of the interviewees' answers.

To conclude the final result of each indicator, this research uses several rules. First, if the sub-indicators have same values, e.g. all sub-indicator are high, the indicator will be the same as well. Second, the lowest value of the sub-indicators is preserved when aggregating the sub-indicators. Therefore, any information that is included in each sub-indicator would be maintained. For example, if two sub-indicators are high but one of them is low, the indicator will be denoted as high (-). If there are only 2 (two) sub-indicators within an indicator and the values are high and low, the indicator will be represented as medium. If at least 2 (two) sub-indicators are medium, the indicator will be also medium.

**Table 9. Decision table to classify the value of each indicator**

| Sub-indicator A | Sub-indicator B | Sub-indicator C | Indicator X |
|-----------------|-----------------|-----------------|-------------|
| high            | high            | low/medium      | high (-)    |
| high            | high            | high            | high        |
| high            | medium          | low             | medium      |
| medium          | medium          | low             | medium      |
| medium          | medium          | medium          | medium      |
| medium          | medium          | high            | medium      |
| low             | low             | low/medium      | low (+)     |
| low             | low             | low             | low         |

## 5.2. Analysis of the interviews result

There are 9 (nine) indicators (table 7) that are assessed in order to discover the use of SDI in spatial planning in Indonesia. Next subchapter will explain the use of SDI in spatial planning in Indonesia for each indicator. The final result will be presented in chapter 7.

### 5.2.1. Awareness of SDI

The main concern of examining the SDI awareness is to know the awareness of the local government to the SDI concepts in Indonesia and the existing of organized SDI-related networks and communication channels. I also asked whether the local government intensively communicate with Bakosurtanal or other SDI networks in Indonesia. Spatial data would be gathered more efficiently if the level of awareness amongst local planners is high (Nedovic-Budic et al., 2004).

There are 3 (three) types of scoring results: high, medium and low. High means that the local government is aware of SDI concepts and makes use of organized SDI-related networks or its communication channels. Medium signifies that although the local government is aware of SDI concepts, they do not utilize SDI-related networks and its communication channels. Low means either the local government is not familiar with SDI concepts or they do not utilize SDI-related networks and its communication channels.

**Table 10. Awareness of SDI in research area**

|   | <b>Sleman</b> | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|---|---------------|----------------------|-----------------|---------------------|------------------|------------------|
| Understanding of SDI concepts (high/medium/low)                       | medium        | medium               | low             | medium              | medium           | medium           |
| Awareness of National clearinghouse and geo-portals (high/medium/low) | high          | high                 | low             | high                | high             | high             |
| Communication with NSDI coordinator and its nodes (high/medium/low)   | low           | medium               | medium          | high                | low              | medium           |
| <b>Awareness of SDI (high/medium/low)</b>                             | <b>Medium</b> | <b>Medium</b>        | <b>Low (+)</b>  | <b>High (-)</b>     | <b>Medium</b>    | <b>Medium</b>    |

As preceding researches have pointed out, the NSDI is already recognized (Puntodewo and Nataprawira, 2007), but the awareness of SDI concepts and policies amongst local authorities need to be improved. Most of local planners, especially young officers or staffs, know the term of SDI. However, in the level of management, for instance in Semarang, some are not familiar with this term. An informant in Semarang said that he has ever heard this term but do not have lots of info about it. Another informant in Semarang professed that he only heard the term in a class or presentation long time ago. While these findings may imply considerable variability in the knowledge of the NSDI in local governments, I also found very limited knowledge of NSDI concepts and policy. For example, some informants said that SDI is only operated and maintained by Bakosurtanal although several ministries, according to the Presidential Decree No.85 of 2007, have been appointed as the SDI nodes. Another informant did not know evenly that a local spatial data network has been established within his area.

Most of the informants, except for Semarang, has ever visited Bakosurtanal's site and know that there are spatial datasets available to download. Moreover, our informants in East Java had ever tried to download a set of spatial data from this site. Most of them said that the spatial datasets offered in this site is not suitable for their needs. They also professed that the

requirements, e.g. login, paying specific spatial datasets, etc., to acquire the spatial datasets from Bakosurtanal's site is burdensome. The other reason is that they have already handed over the spatial data provision for the arrangements of local plan to private consultant. Therefore, they only use the spatial datasets from Bakosurtanal only when needed which are obtained traditionally using CD/DVD. The site, however, can be easily found. There is sitemap which guides the visitor to locate something. The visitor can also find useful links in which they can acquire the needed spatial datasets.

The informants were also asked for how often they communicate with Bakosurtanal or other SDI nodes in the arrangements of spatial planning. Most of them admitted that they contacted Bakosurtanal in BKPRD meeting. The BKPRD meeting is held every 3 (three) months confronting all stakeholders in spatial planning. Our informant in DI Yogyakarta, Semarang and East Java confessed that they met Bakosurtanal when they needed Bakosurtanal's advice and approval to the accuracy and suitability of their spatial datasets before they asked for a substantial approval from Minister of Public Works, while Sleman and Bangkalan communicate with Bakosurtanal through the third parties (private consultant or other government agencies). Central Java also contacted Bakosurtanal to involve in a GIS short course in their area. The course is conducted to increase the capability of their human resources in dealing with GIS technology.

Most of our informants have a considerable awareness of SDI. Some of them instead, such as DI Yogyakarta and East Java are developing a local spatial data network (Jaringan Data Spasial Daerah/JDSD) which is connected to national clearinghouse and geo-portals. The local spatial data networks are still in the development process and expected as the backbone of local geo-information activities. In the future, the local spatial data networks will support NSDI activities. While other local governments are still developing their local spatial data networks, Central Java has had the most progressive local spatial data networks ([www.jdsd.bappedajateng.info](http://www.jdsd.bappedajateng.info)) since 2009. They have established a local geo-portal equipped with a directory where the visitors can easily find spatial data by typing the name of the needed spatial data. Currently, they also still make their spatial data network better by embracing the cities and regencies within their jurisdiction which have not been connected to their spatial data network. An interesting remark is Semarang that has low value. Although they communicate frequently with NSDI coordinator and its nodes, their understanding of SDI concepts and awareness of national clearinghouse and geo-portals are relatively low. Therefore, Bakosurtanal as NSDI coordinator shall transfer their knowledge to the local government in order to increase the local government acknowledgement to national SDI.

### **5.2.2. Data availability**

The second indicator to measure is data availability. This indicator is to scrutinize how the local governments acquire spatial data in the drafting of general or detailed spatial plan. I want to observe whether SDI networks and nodes provide spatial data for local planning. I also asked whether the local governments made their spatial data by themselves.

The result of evaluation can be high, medium or low. High means that the spatial data can be easily found without the local government needs many efforts to locate, acquire and have the required spatial data. Medium denotes that the local government can find spatial data but some improvement could be made, whereas low indicates that the local government hardly finds the needed spatial data.

There are 3 (three) categories of information exchange take place from which the local governments acquire the spatial data. The first kind is trans-vertical information exchange through the coordinator of Indonesia SDI (Bakosurtanal). There are also trans-vertical information exchanges from other government agencies that also play a role as SDI nodes (see table 3), for instance Ministry of Public Works, BPS (Statistics Central Agency), etc. Almost all local governments make use of spatial data from SDI coordinator and nodes. The last category is the trans-horizontal agencies that are local government agencies in the same area that work together with Bappeko/Bappekab/Bappeda/Dinas Cipta Karya dan Tata Ruang in the formulation of local planning, such as Dinas Pertanian (Local Agriculture Agency), Kanwil BPN, Dinas Pariwisata (Local Tourism Board), etc. Only DI Yogyakarta acquires spatial data from other local government agencies within DI Yogyakarta jurisdiction to create single base maps.

**Table 11. Data availability**

|  | <b>Sleman</b>  | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|--|----------------|----------------------|-----------------|---------------------|------------------|------------------|
| Sources of spatial data (high/medium/low)  | high           | low                  | high            | high                | high             | high             |
| Access mechanism (high/medium/low)         | low            | medium               | low             | low                 | low              | medium           |
| Internal production (high/medium/low)      | low            | high                 | low             | medium              | low              | medium           |
| <b>Data availability (high/medium/low)</b> | <b>Low (+)</b> | <b>Medium</b>        | <b>Low (+)</b>  | <b>Medium</b>       | <b>Low (+)</b>   | <b>Medium</b>    |

Three access mechanisms are examined in this project. First, the spatial data can be downloaded from Bakosurtanal's site or SDI geo-portals. Second, the local governments send a request and receive the data via email. Third, the local governments get the spatial data traditionally by means of CD/DVD. The local government will be scored high if they exploit all access mechanisms, medium if they make use of 2 (two) access mechanisms and low if they only use 1 (one) access mechanism.

Almost all of the informants get the spatial data from other government agencies including Bakosurtanal by means of CD/DVD. Only East Java has ever tried to download a set of spatial data from Bakosurtanal's site. Aside from their affirmation that most of spatial data are not suitable with their needs, our informants assert that they often fail to download the spatial data either from the Bakosurtanal's site or local spatial data network since they do not have a good internet connection and bandwidth. DI Yogyakarta used to use email to acquire spatial data from SDI networks.

DI Yogyakarta produce spatial datasets for spatial planning formulation since most of spatial data in SDI networks are not suitable with their needs. The scale of spatial data is larger than that of the needed one. Instead, some of them, for instance Sleman, Semarang and Bangkalan, act as passive users. During spatial planning arrangements, they handed over almost all of the process of spatial data processing (acquisition, pre-processing, analyzing and representation of the spatial data) to the third parties such as academia or private sectors. However, Bangkalan still supplied some spatial data required by the third parties. Two local governments, Central Java and East Java, involved in the data processing although they were also helped by the third parties. They act as an active user that direct the producers of the datasets (third parties) and had a final product of map that can be used to formulate local spatial plan.

If the local government produces spatial datasets for their needs, the sub-indicator internal production is high. If the local government acts as active user, the sub-indicator internal

production is medium. Otherwise, the sub-indicator internal production is regarded low if the local government acts as passive user.

The third parties that helped the local government during spatial planning arrangements can be academia or private sectors. Private sectors that helped the local governments, such as in Semarang and Central Java, bought high-accuracy satellite images (Ikonos and Quickbird) from other parties. East Java, on other hand, got the spatial data via academia (Institut Teknologi 10 Nopember Surabaya) who bought base map from Bakosurtanal. The spatial data are then processed, analyzed, and validated by East Java with the support of Universitas Gadjah Mada (UGM). During the analytical and validation process of spatial data, they also used high-accuracy satellite images.

Our informants in DI Yogyakarta claim that they produce a single base map. They are proud to be the first province in Indonesia that produces a single base map. The single base map has already been checked by Bakosurtanal and submitted to Bakosurtanal to enrich the spatial data archives of Bakosurtanal. Moreover, the Governor of DI Yogyakarta has passed a local regulation that requires all government agencies within his jurisdiction to use the single base map for their works.

To summarize, access networks of SDI are not adequate enough for the formulation of local planning. Although most of them got spatial data from many sources (trans-vertical or trans-horizontal), they still used traditional way to acquire the data. One of them (DI Yogyakarta) decided to create and produce spatial data to supplement their spatial data since they consider that spatial data from SDI network is quite expensive and not all of them are relevant for their work.

### **5.2.3. Data sharing accessibility**

Data sharing accessibility is used to evaluate the accessibility of the spatial data. By measuring this indicator, I might detect factors that might impede the use of SDI in spatial planning. There are 3 (three) types of evaluation results: high, medium and low. High indicates that spatial data from SDI networks are shared and easily accessed for local planning. The local government also takes part by having a will to share their spatial data to other users. Medium means that spatial data are only accessible to some organizations, e.g. only to government agencies, but only derived or specific products. Low means that data distribution of spatial data from SDI networks or the local government to other local government is restricted or never happened.

Three subjects were prompted to the informants. First, I asked the data exchange agreements that might be signed by the local government with other agencies or institutions in any data exchange activities. Second, I inquired the data sharing policy that might be applied by the local government to data users. Third, I asked revenue that is collected by the local government when data users want to use their spatial data.

If there is a government law which enables the local government to get spatial data freely from Bakosurtanal or other SDI nodes, the sub-indicator data exchange agreements is high. If there is a contract between the local government with Bakosurtanal or other SDI nodes that facilitates the local government to get spatial data freely from Bakosurtanal or other SDI nodes, the sub-indicator data exchange agreements is medium. Otherwise, the sub-indicator data exchange agreements is low.

All of our informants stated that they obtained the needed spatial data by request to the data producers. The data producers can be Bakosurtanal or other SDI nodes. None of them is having any contract with Bakosurtanal or other SDI nodes. In fact, there is no government law which enables the local government to get spatial data freely from Bakosurtanal or other SDI nodes. However, the governor DI Yogyakarta has gone one step forward in this matter by enacted a local regulation that facilitates any government agencies within his subordinate to acquire the single base map for their works freely from Bappeda DI Yogyakarta. The governors of Central Java have also passed a local regulation about local spatial data network and its use although there is no obligation for local agencies in Central Java to use spatial datasets in local spatial data network for spatial planning arrangements.

**Table 12. Data sharing accessibility**

|  | <b>Sleman</b>  | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|--|----------------|----------------------|-----------------|---------------------|------------------|------------------|
| Data exchange agreements (high/medium/low)                         | low            | low                  | low             | low                 | low              | low              |
| Data sharing policy (high/medium/low)                              | medium         | high                 | medium          | medium              | medium           | medium           |
| Transaction costs of spatial data from SDI nodes (high/medium/low) | low            | medium               | low             | medium              | medium           | medium           |
| <b>Data sharing accessibility (high/medium/low)</b>                | <b>Low (+)</b> | <b>Medium</b>        | <b>Low (+)</b>  | <b>Medium</b>       | <b>Medium</b>    | <b>Medium</b>    |

All local government is willing to share their spatial data with some conditions. Generally, any other government agencies or people can have any spatial data from the local government by request. Even so, the local government only permits them to have the spatial data in JPEG format. If they want the SHP or the genuine file format of the spatial data, they have to send a formal request by mail. Data sharing accessibility in DI Yogyakarta is high since as mentioned beforehand has a local regulation that enables any government agencies within DI Yogyakarta to get the single base map for their works freely from Bappeda DI Yogyakarta.

The general condition that is applied to data users by the local government is “Data used for requested purpose and not shared with others without permission”, especially if the data users acquire the genuine file format of the spatial data. This means that the data users should not share to other data users without any notification to the local government who has the copyright. This is also one of the reasons why the local government is only willing to share the spatial data in JPEG format.

There are several reasons of why local government pays a big attention in spatial data distribution. “Avoid data misuse” is the common reason of why the local government is having a reluctance to share spatial data in its genuine file format. The other reasons are “Maintain data distribution control” and “Economic protection”.

When asked how much the costs that had to be paid by the local governments if they wanted to get the spatial data from SDI nodes, our informants in Sleman and Semarang professed that they usually bought thematic maps from central government agencies, which are also SDI nodes, through the private consultant who helped them in the arrangements of spatial planning. Therefore, they were asked for a production cost. DI Yogyakarta also admitted that they used to buy thematic maps from Bakosurtanal and had to pay these thematic maps before they make a single base map for their own purpose. Other local governments, Central Java, Bangkalan and East Java stated that they got base map from Bakosurtanal and also thematic maps from other

local government agencies within their jurisdiction without any costs, but they still had to pay thematic maps from central agencies, i.e. Bakosurtanal, BPS.

As a conclusion, the data sharing within all local governments is only accessible to some organizations for specific products. Therefore, the data sharing accessibility for all local governments, except for Sleman and Semarang, is quite limited accompanied with specific conditions. Sleman and Semarang need to improve their data sharing accessibility since it can be restricted by data exchange policy and transaction costs. In the future, it is expected that data sharing can be accessible for any data users without any restriction. Also, the national government should play an active role in data sharing by establishing a government law that provides an opportunity to the local government to have a free access in obtaining a spatial data from SDI networks.

#### 5.2.4. Relevance to local planning

The main point of this indicator is to evaluate the relevance of spatial data in SDI networks toward the needs of local planning practice. In this event, I would like to observe how relevant is spatial data offered by SDI networks for local planning. If most of the spatial data is relevant, it will be likely that SDI supports local planning.

The result of assessment is high, medium or low. High signifies that most of spatial data in SDI networks are appropriate enough for local planning. The local government can use the spatial data for local planning without a lot of adjustments or modification. Medium means that only several themes of spatial data in SDI networks are suitable for local planning and the local government for local planning with some adjustments or modifications. Low indicates that spatial data in SDI networks are not appropriate for local planning. If the local governments are still willing to use it, they have to make a lot of efforts to adjust the spatial data.

**Table 13. Relevance to local planning**

|  | Sleman        | DI Yogyakarta  | Semarang      | Central Java  | Bangkalan     | East Java     |
|--|---------------|----------------|---------------|---------------|---------------|---------------|
| Number of appropriate data (high/medium/low)         | low           | low            | medium        | medium        | medium        | medium        |
| Scale and content suitability (high/medium/low)      | medium        | low            | medium        | medium        | low           | medium        |
| Metadata quality (high/medium/low)                   | high          | medium         | high          | high          | high          | high          |
| <b>Relevance to local planning (high/medium/low)</b> | <b>Medium</b> | <b>Low (+)</b> | <b>Medium</b> | <b>Medium</b> | <b>Medium</b> | <b>Medium</b> |

Almost all of the local governments in this research use single base map provided by Bakosurtanal in the formulation of local spatial plan. Unlike any thematic maps offered by Bakosurtanal, they confessed that the single base map is free. The thematic maps usually are obtained from other local government agency traditionally via CD/DVD. However, the single base map has a large scale which is not suitable for their needs. Sleman and DI Yogyakarta stated that the number of spatial data from SDI nodes that is suitable for local planning is less than their needs. This is also the reason of why DI Yogyakarta produces a single base map. Moreover, usually they also got the needed spatial data from the third parties, e.g. private sector or academia. They also obtained other thematic maps or spatial data from local government agency within the same province/city/regency. Except for Sleman, the source of spatial data of each local government for spatial planning is illustrated in table 14. I could not have any

information for Sleman since they have not enacted Perda RTRW (Local Spatial Planning Regulation). Therefore, they do not want to publish the source of spatial data in detail yet.

The scale of spatial data from SDI nodes usually is larger than that of the required one. SDI nodes do not provide spatial data which conforms to the local government requirement. In this case, our informants in Bangkalan and also DI Yogyakarta admit that they only got a few of spatial data from SDI networks which conforms the maximum scale according to the draft of scale accuracy regulation. The local government however can still use it, if they like, with some adjustments. Another remark is that the data management by Bakosurtanal was not too good. Usually they obtained the spatial data traditionally through CD/DVD from different person in Bakosurtanal. A problem arose when they needed the same spatial data and asked for it to different person in Bakosurtanal, they would get the same map with different content or accuracy. This problem however has been overcome by Bakosurtanal by establishing one-shop service in 2011.

Furthermore, the spatial data from SDI networks has a good quality of metadata. Bakosurtanal has developed a standard of metadata which is easy to read and understand. For that matter, however, an interesting remark is found in DI Yogyakarta. Our informant in Dinas PU and ESDM Yogyakarta admitted that he did not know the term of “metadata”, but he still could read any information brought by the spatial data.

To summarize, the relevance of spatial datasets in SDI networks for local planning needs to be improved. Although local government still can use the spatial datasets, they still have made some adjustments. Moreover, only a few of spatial data provided by SDI networks are relevant to local planning.

**Table 14. The source of spatial data**

| TYPES OF DATA                       | DI YOGYAKARTA  | SEMARANG  | CENTRAL JAVA   | BANGKALAN   | EAST JAVA  |
|-------------------------------------|--|---|--|---|--|
| Administrative area                 | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | <b>Bakosurtanal</b> 1:25.000, Quickbird 1:10.000, Bappeko Semarang (Semarang Planning Development Agency) 1:10.000  | Bappeda Jawa Tengah (Central Java Planning Development Agency) 1:25.000, <b>Bakosurtanal</b> 1:25.000  | <b>Bakosurtanal</b> 1:50.000, Bappeko Bangkalan (Bangkalan Planning Development Agency) 1:25.000                    | <b>Bakosurtanal</b> 1:25.000   |
| Physical geography                  | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000, Bappeko Semarang 1:10.000   | -  | -   | -  |
| Population                          | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000 and <b>BPS (Statistics Central Agency)</b> 1:100.000   | Bappeda Jawa Tengah (Central Java Planning Development Agency) 1:25.000  | Bappeko Bangkalan 1:25.000, <b>Bappeda Jawa Timur (East Java Planning Development Agency)</b> 1:25.000              | Bappeda Jawa Timur (East Java Planning Development Agency) 1:25.000, <b>BPS (Statistics Central Agency)</b> 1:50.000   |
| Economic and financial              | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000 and Bappeko Semarang 1:10.000  | Bappeda Jawa Tengah (Central Java Planning Development Agency) 1:25.000, <b>BPS (Statistics Central Agency)</b> 1:25.000   | Bappeko Bangkalan 1:25.000, <b>BPS (Statistics Central Agency)</b> 1:50.000   | Bappeda Jawa Timur (East Java Planning Development Agency) 1:25.000  |
| Infrastructure and basic facilities | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000, Bappeko Semarang 1:10.000, <b>Dinas Cipta Karya dan Taru Jawa Tengah (Housing and Planning Agency of Central Java)</b> 1:10.000, <b>Dinas Perhubungan Jawa Tengah (Transportation Agency of Central Java)</b> 1:100.000 | <b>Bakosurtanal</b> 1:25.000, <b>Kementerian PU (Ministry of Public Works)</b> 1:50.000, <b>Dinas Bina Marga Jawa Tengah (Road Infrastructure Agency of Central Java)</b> 1:25.000 | Bappeko Bangkalan 1:25.000, <b>Dinas Bina Marga Bangkalan (Road Infrastructure Agency of Central Java)</b> 1:25.000 | <b>Dinas Perhubungan Jawa Timur (Transportation Agency of East Java)</b> 1:100.000, <b>BPJN Kanwil Jawa Timur (East Java Branch of National Land and Cadastre Agency)</b> 1:100.000, <b>Dinas Sosial Budaya Jawa Timur (East Java Culture and Social Agency)</b> 1:100.000 |

|                      |  |   |  |   |  |
|----------------------|--|---|--|---|--|
| Land use             | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Bakosurtanal 1:25.000, Quickbird 1:10.000, Bappeko Semarang 1:10.000, <b>Dinas Pertanian Semarang (Agriculture Agency of Semarang)</b> 1:100.000, <b>BPN Semarang (Semarang Branch of National Land and Cadastre Agency)</b> 1:100.000, <b>Dinas Kehutanan Jawa Tengah (Forestry Agency of Central Java)</b> 1:25.000 | <b>Bakosurtanal</b> 1:25.000, Landsat 2006 1:25.000  | Bappeko Bangkalan 1:25.000  | <b>Bakosurtanal</b> 1:25.000, Landsat 5ETM 1:10.000, Landsat 7ETM 1:10.000   |
| Allotment of space   | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000 and Bappeko Semarang 1:10.000  | <b>Bakosurtanal</b> 1: 25.000, <b>Dinas ESDM Jawa Tengah (Energy and Mineral Resources Agency of Central Java)</b> 1: 50.000   | Bappeko Bangkalan 1:25.000, <b>Kementerian PU (Ministry of Public Works)</b> 1:50.000 | <b>Bakosurtanal</b> 1:25.000, <b>Dinas Hidro Oseanografi TNI AL (Hydro Oceanography Agency)</b> 1:250.000  |
| Disaster-prone areas | Bappeda DI Yogyakarta (DI Yogyakarta Planning Development Agency) 1:50.000 | Quickbird 1:10.000, Bappeko Semarang 1:10.000, <b>Dinas PU Semarang (Semarang Public Works Agency)</b> 1:100.000, <b>BMKG Semarang (Climatology, Meteorology and Geophysics Agency of Semarang)</b> 1:100.000   | <b>Bakosurtanal</b> 1: 25.000, <b>Kementerian ESDM (Ministry of Energy and Mineral Resources)</b> 1: 50.000, <b>Dinas PSDA Jateng (Water Resources Agency of Central Java)</b> 1: 50.000 | Bappeko Bangkalan 1:25.000  | <b>Dinas ESDM Jawa Timur (Energy and Mineral Resources Agency of Central Java)</b> 1:25.000, <b>Dinas Lingkungan Hidup Jawa Timur (Environment Agency of East Java)</b> 1:50.000 |

Notes:

- Bappeda DI Yogyakarta, Bappeko Semarang, Bappeda Jawa Tengah, Bappeko Bangkalan and Bappeda Jawa Timur are the responsible agencies in spatial planning arrangements in DI Yogyakarta, Semarang, Central Java, Bangkalan and East Java respectively.
- **Bakosurtanal** is the SDI coordinator.
- The agencies written **bold** in black are the national SDI nodes.
- The agencies written **bold** in red are the local SDI networks.
- The agency written **bold** in brown is the supporting agency in SDI networks.

### 5.2.5. Data standard and ease of data integration

Data standard is one of the main concerns of SDIs. Standardization of spatial data may increase connectivity between data users so they can exchange and use spatial data easily. As a result, it may increase the effectiveness of spatial data use. Another advantage of data standard is that every data user can set a rule of thumb for spatial data.

At this point, 2 (two) points were asked to the informants. First, I asked the file format of local government's spatial data. Second, the compatibility of spatial data obtained from SDI networks with the software used by the local government. I assume that if spatial data in SDI networks has similar file format with the local government's spatial data, the local government may use it without problems. Thus, it may increase the effectiveness of the local government work.

Three evaluation results are used: high, medium or low. High means all spatial data in SDI networks has similar file format with the local government's spatial data and the local government can use it effectively. Medium denotes some of spatial data in SDI networks has different file format with the local government's spatial data and the local government has to convert it before they use it. Low indicates that the spatial data in SDI networks has different file format each other and the local government has to convert it if they want to use it.

**Table 15. Data standard and ease of integration**

|   | <b>Sleman</b> | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|---|---------------|----------------------|-----------------|---------------------|------------------|------------------|
| File format standard (high/medium/low)                              | medium        | high                 | high            | high                | medium           | medium           |
| Compatibility of spatial data (high/medium/low)                     | medium        | high                 | high            | high                | medium           | medium           |
| <b>Data standard and ease of data integration (high/medium/low)</b> | <b>Medium</b> | <b>High</b>          | <b>High</b>     | <b>High</b>         | <b>Medium</b>    | <b>Medium</b>    |

The file format standard value will be valued high if there is only 1 (one) file format standard used. If 2 (two) file format standard is used, the file format standard is considered medium. Otherwise, if the local government use more than 2 (two) standard, the file format standard is regarded low.

The file format of their spatial data is usually SHP or combination between SHP and DWG. Our informants in Sleman, Bangkalan and East Java use SHP and DWG file format. One of them (Bangkalan) said that he is familiar with DWG format brought by AutoCAD. On the other hand, he admitted that he also had to learn of how to use ArcView during the formulation of spatial planning since he got spatial datasets in SHP format. Other informants in Sleman and East Java used 2 (two) different file formats to avoid problems when they got spatial data in different format.

Almost all of spatial data provided by SDI networks uses SHP format. Therefore, the compatibility of spatial data used by the local government is relatively high. Sleman, Bangkalan and East Java admitted that they sometimes acquired different file format from other local government agencies during spatial planning formulation. Therefore, they need to convert it a little bit. In addition, our informant in East Java stated that in the past they experienced a problem when they collected spatial data for the development of Spatial Data Network of East Java. The problem was they got spatial data in different file format from other government

agencies within East Java. Since then, they asked other government agencies to use the same format (SHP).

Since the compatibility of spatial data of all of our informants is relatively sufficient (high or medium), currently there is no problem of data standard. Thus, data integration vertically between different levels of local government or between local government and SDI networks is relatively uncomplicated.

### 5.2.6. The effect on decision making process

The strength of commitment could vary depending on the personal meaning coupled with the commitment foci (Abrahamsson, 2001). The local government would commit to SDI in spatial planning arrangements only if SDI plays a vital role in their work. Hence, the effect brought by SDI, especially its spatial data, on decision making process during spatial planning arrangements shall be examined.

Three things were posed to our informants concerning this matter. Firstly, who are the users of spatial information? Secondly, what is the benefit brought by spatial information? Lastly, what is the contribution of spatial information to the organization?

The resulting assessment can be high, medium or low. High means that the decision makers are very dependent with spatial information. They also regard spatial information as a valuable asset. Medium means that the decision makers use spatial information as alternative that also may justify their decision. Spatial data is viewed as additional data to support the organization tasks. Low indicates that the decision makers do not expect much good to come from spatial information. Their decision will be made no matter how good spatial information will be.

**Table 16. The effect on decision making process**

|  | Sleman          | DI Yogyakarta | Semarang        | Central Java    | Bangkalan       | East Java       |
|--|-----------------|---------------|-----------------|-----------------|-----------------|-----------------|
| Information users (high/medium/low)                            | low             | high          | high            | high            | high            | high            |
| Benefit brought by spatial information (high/medium/low)       | high            | high          | medium          | high            | high            | medium          |
| Contribution of spatial information (high/medium/low)          | high            | high          | high            | medium          | medium          | high            |
| <b>The effect on decision making process (high/medium/low)</b> | <b>High (-)</b> | <b>High</b>   | <b>High (-)</b> | <b>High (-)</b> | <b>High (-)</b> | <b>High (-)</b> |

The value of sub-indicator information users will be valued high if all people within the organization entity use spatial information during spatial planning process. Organization here means the local agency that is responsible for spatial planning arrangements, e.g. Bappeda/Bappekab/Bappeko (Local Planning and Development Agency) and Dinas Cipta Karya dan Tata Ruang (Local Planning and Housing Agency). If only certain people, e.g. management level, and spatial planning department makes use of spatial information, information users is considered medium. Otherwise, if only spatial planning department makes use of spatial information, information users is regarded low.

In Sleman, only spatial planning department makes use of the spatial information. Other local government confessed that the spatial information is used by all entities within the organization. This means that everybody in those local governments uses the spatial information for work.

Most of local governments also think that spatial information plays important role in spatial planning formulation. They realize that any decision cannot be made without spatial information. Some of these governments have also established local regulation that organizes the use of spatial data within local spatial data network, e.g. DI Yogyakarta. Two local governments, Semarang and East Java, view spatial data as additional data to support the organization tasks.

Although some of them are assisted by the third parties in spatial datasets provision, most of local governments regard spatial data as an integral part of the organization activities. Central Java and Bangkalan do not consider spatial data as the integral part of their duties. Central Java however claimed that spatial data from SDI network has supported their job. Our informant in Bangkalan added that although he was assisted by private consultant in spatial datasets provision, the spatial data has increased the efficiency and quality of information management in his organization.

Despite variability of sub-indicators results, all of local governments in the study area regard spatial data from SDI network as valuable asset. The spatial information gives benefits to the local governments. They assert that spatial data from SDI network supports their work. In other words, the spatial data has brought a good effect in spatial planning arrangements.

### 5.2.7. Local cooperation and coordination

Rajabifard et al. (2001) explains SDI as a process model, illustrated by Figure 5, as a model that defines the SDI as a coordinating organization that provides a communication channel for people to share and use datasets. This model needs cooperation and coordination by all users. By increasing the cooperation and coordination, the communication channels would be effective to support SDI development.

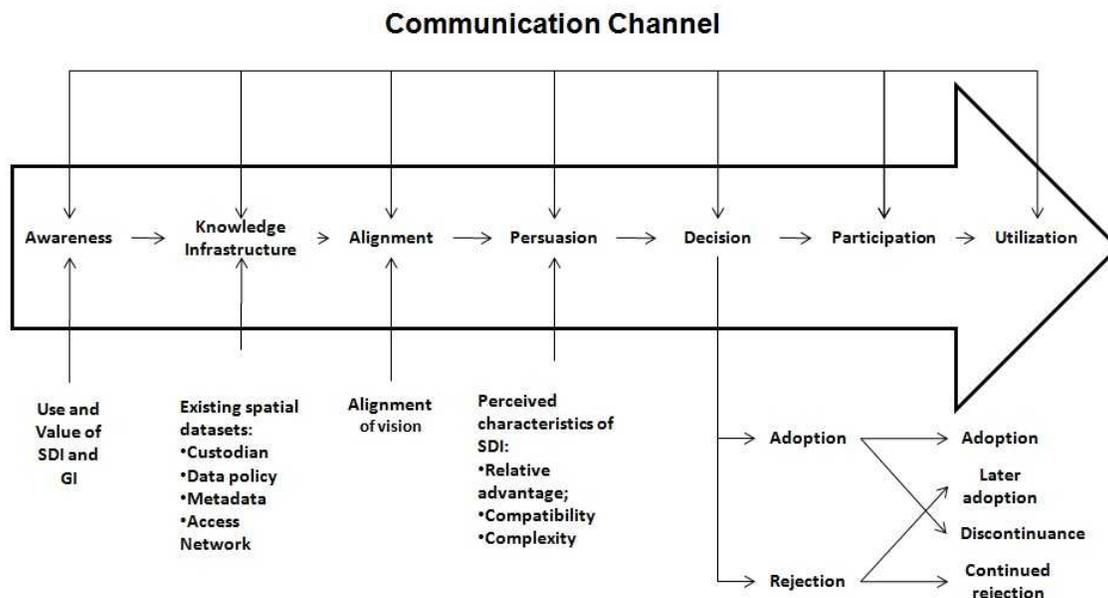


Figure 5. Process based model

The level of local cooperation and coordination by observing the coordination between government agencies is examined. The kind of coordination is also inspected. The coordination process, as mandated by Presidential Decree No.85 of 2007, can be done during spatial data collection, maintenance of the data or only when using the data. The data collection is done by appointing one as the data collector and every party who produces spatial data and involves in data sharing process should submit the data to the coordinator. The maintenance process is coordinated by assigning one to store and manage the spatial data before it is used. The coordination process during the use of the data can be done by compelling every party to use certain spatial data or assigning one as the coordinator who check spatial data used by other party to maintain the accuracy and consistency.

The resulting assessment can be high, medium and low. High means the local government involves in all coordination processes. Medium means the local government partakes in 2 (two) coordination processes, whereas low denotes the local government only get involved at least in 1 (one) coordination process.

**Table 17. Local cooperation and coordination**

|   | <b>Sleman</b> | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|---|---------------|----------------------|-----------------|---------------------|------------------|------------------|
| Coordination between government agencies (high/medium/low)  | high          | high                 | high            | high                | high             | high             |
| Type of coordination (high/medium/low)                      | high          | low                  | high            | low                 | high             | high             |
| <b>Local cooperation and coordination (high/medium/low)</b> | <b>High</b>   | <b>Medium</b>        | <b>High</b>     | <b>Medium</b>       | <b>High</b>      | <b>High</b>      |

According to the observation, all local governments involve in coordination process. Usually they contact other government agencies in the same area in the provision of spatial data. At least every 3 (three) months they conduct a regular meeting to discuss spatial planning arrangements. During the meeting they also discuss any problems concerning spatial data. They also have a different meeting talking about local spatial data network. Moreover, Sleman also carries out ad hoc meeting with neighborhood areas during spatial planning arrangements.

Furthermore, 2 (two) local governments (DI Yogyakarta and Central Java) only involve in the coordination of the use of spatial data from local spatial data network. DI Yogyakarta has established a local rule compelling their subordinate to use single base map they have produced. Central Java on the other hand has launched a local geo-portal and recommends their subordinate to locate spatial data in that geo-portal.

Most of local governments involve in all coordination processes. They assign one of local agency to be data collector, usually Bappeda/Bappekab/Bappeko. The data collector also maintains the spatial data and disseminate to other government agency that needs it. Additionally, they also work with Bakosurtanal to check the accuracy and consistency of spatial data.

Local cooperation and coordination between local government agencies is relatively high. Only DI Yogyakarta and Central Java do not optimize the coordination processes. Based on our observation, local agencies are open to their colleagues and willing to assist each other in the

arrangements of spatial planning. These circumstances would pave a way to the betterment of national SDI of Indonesia.

### 5.2.8. Formal policy

Formal policy is examined since it is interesting to know the awareness and the opinion of the local government to this regulation. When I study Government Regulation No. 10 of 2000, which regulates the accuracy level of maps for spatial planning arrangements, I do not see any article regulating data standard or metadata. Currently, there is no other law which regulates data standard, metadata, or spatial data provision for local planning. The central government however is preparing to establish a new law to substitute Government Regulation No. 10 of 2000. The law also covers the content, scale, minimum types of required spatial data for spatial planning, metadata, standard and spatial data management.

Two main concerns are raised to examine the formal policy. First, I observe the awareness of the local government to the national regulation, i.e. Government Regulation No. 10 of 2000. Second, I asked whether the local government also published local law that covers SDIs or spatial data provision for local planning.

The result of assessment for this indicator is high, medium or low. High signifies that the local government is aware of Government Regulation No. 10 of 2000 and has enacted local regulation to back SDI. Medium means the local government is aware of Government Regulation No. 10 of 2000 and is formulating the local regulation to support the development of SDI. Low indicates the local government is unaware of Government Regulation No. 10 of 2000 and any local regulation supporting the development of SDI has not been published yet.

**Table 18. Formal policy**

|  | Sleman          | DI Yogyakarta | Semarang      | Central Java    | Bangkalan     | East Java   |
|--|-----------------|---------------|---------------|-----------------|---------------|-------------|
| Awareness to national regulation (high/medium/low) | medium          | high          | high          | medium          | high          | high        |
| Local regulation (high/medium/low)                 | high            | high          | low           | high            | low           | high        |
| <b>Formal policy (high/medium/low)</b>             | <b>High (-)</b> | <b>High</b>   | <b>Medium</b> | <b>High (-)</b> | <b>Medium</b> | <b>High</b> |

Most of local governments are aware of Government Regulation No. 10 of 2000 and know its content very well. Only Sleman and Central Java has ever heard the regulation. Both local governments however were informed that there will be a new regulation that substitutes Government Regulation No. 10 of 2000.

Other local governments are aware of Government Regulation No. 10 of 2000 regarding map accuracy. They also know that the central government is formulating a new law to substitute Government Regulation No. 10 of 2000. They were also suggested by Bakosurtanal to adopt scale accuracy regulated by the new law although the law is not yet passed. In addition, they also suggest the central government to improve the scale accuracy regulation in Government Regulation No. 10 of 2000.

When I asked whether the local government published a local regulation to support SDI or spatial data provision for local planning, I have two various answers. Semarang and Bangkalan admitted that currently there is no local regulation regarding SDI or spatial data provision. Sleman and DI Yogyakarta have published a local regulation regarding data sharing transaction

costs and the use of single base map respectively, while Central Java and East Java have established a local law concerning the development of local spatial data network.

To conclude, all of local governments have supported SDI policy. Although not all of them have issued a local regulation to support the development of SDI, the formal policy has been penetrated to the local government. In the future, it is expected that the new law that substitute Government Regulation No. 10 of 2000 also supports the development of SDI.

### 5.2.9. Implementation capacity

Matindas et al. (2004) asserts the main issues that obstruct the development of Indonesia's SDI (ISDI) are data duplication, low quality data, poor management and low participation of stakeholders. The problem of poor management is caused by lack of human resources in geo-information field (De Vries, 2006). The human resources states at the local level in geo-information field are scarce and distributed randomly. Thus, the implementation capacity in geo-information field is required to observe.

Three subjects of question were observed to study the implement capacity. First, how does the local government organize the task of GIS experts in their organization? Second, what is the software used by the GIS experts to support their duty? Lastly, how is the level of capacity of the GIS experts?

There are 3 (three) resulting assessment for implementation capacity: high, medium or low. High means the GIS experts are very advanced and are assigned exclusively in spatial planning unit within the local government. Medium means the GIS experts are not quite advanced or they are not assigned exclusively in spatial planning unit within the local government. Low indicates the capacity of the GIS experts needs to be improved and they are not assigned exclusively in spatial planning unit within the local government.

**Table 19. Implementation capacity**

|  | <b>Sleman</b> | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|--|---------------|----------------------|-----------------|---------------------|------------------|------------------|
| Task division (high/medium/low)                  | medium        | medium               | low             | medium              | low              | low              |
| Level of capacity (high/medium/low)              | medium        | medium               | low             | high                | high             | high             |
| <b>Implementation capacity (high/medium/low)</b> | <b>Medium</b> | <b>Medium</b>        | <b>Low</b>      | <b>High (-)</b>     | <b>Medium</b>    | <b>Medium</b>    |

The GIS experts in Semarang, Bangkalan, and East Java are not assigned exclusively in spatial planning unit within the local government. They are also responsible for GIS matters in the organization. Therefore, the task division within these local governments is low. GIS expert in local government may perform their best if they are specialized only in spatial planning unit. So, they can focus on assisting spatial planning arrangements.

Sleman, DI Yogyakarta and Central Java have assigned their GIS experts exclusively in spatial planning unit. However, there is no specialization for the GIS experts within the unit. Thus, the task division in these local governments is medium since GIS experts may optimize their performance if they are assigned to a specific task in spatial planning unit.

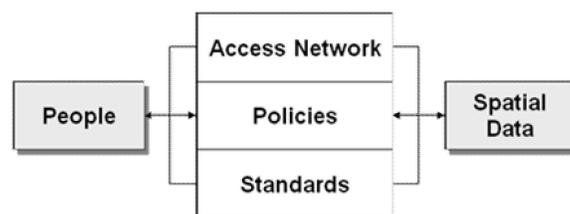
Almost all local governments have advanced skills GIS experts. Most of them have sufficient experience in GIS field although some of them are relatively new employees in the local

government agencies, i.e. Sleman and DI Yogyakarta. Some of them can handle two kinds of software, usually ArcGIS and ArcView. The rests are familiar with the combination between ArcGIS, ArcView, ArcInfo or AutoCAD. The ones who are responsible for GIS matters in Semarang are not really GIS experts since their background was urban planning. Also, our informant in Semarang professed that they handed over most of spatial data processing to the private sector. Hence, the level of capacity of GIS experts in Semarang is low.

To summarize, the implementation capacity in nearly all local governments are quite adequate, while Semarang need to improve the implementation capacity. In this case, the implementation capacity in Semarang is low since the level of capacity of GIS experts in Semarang is low and the task division of their GIS experts is low. Also, the local governments need to formulate a better way to optimize their GIS experts although they have adequate skills.

### 5.2.10. Assessment of the use of SDI in spatial planning in Indonesia

Most of local governments within the research areas have a significant awareness of SDI. The spatial data within SDI networks are not adequate enough to support local planning formulation. In fact, the local government must use traditional way to acquire the data, i.e. via CD/DVD or email. Data sharing within all local governments is only accessible to some organizations for specific products. If the data users want the genuine file format of the spatial data, they have to send a formal request by mail. The relevance of spatial datasets in SDI networks for local planning needs to be improved. The local governments still can use the datasets from SDI networks with some adjustments. The compatibility of spatial data is not an issue for the local governments since the same format file is used for data exchange. As a result, data integration vertically between local governments in different level or between local government and SDI networks is relatively uncomplicated. Moreover, spatial information brought by SDI network is regarded as valuable asset. Local cooperation and coordination between local government agencies is relatively high. Local agencies are open to their colleagues and willing to assist each other in the arrangements of spatial planning. SDI policy is also supported by most of local governments. Most of them have established a local regulation that supports SDI development within their area. Further, the implementation capacity still needs to be improved. The local governments shall optimize the role of GIS experts in their organization.



**Figure 6. SDI Components**

Generally, the use of SDI in supporting spatial planning in Indonesia needs to be optimized. According to this research, the provincial governments have utilized SDI for their needs better than the urban government. One interesting remark is Central Java that has developed local spatial data network. Di Yogyakarta and East Java on the other hand is on the process of the development of local spatial data network.

Only 4 (four) indicators effectively support the use of SDI in spatial planning in Indonesia; i.e. data standard and ease of data integration, the effect on decision making process, local cooperation and coordination, and formal policy (see table 20). Linking the core components of

SDI (figure 6) as policy, access network, standards, people and data (Rajabifard et. al., 2001; Rajabifard and Williamson, 2001) with the used indicators, only 3 (three) SDI components (policy, standard and people) support spatial planning formulation even though the human resources (people) and some policy aspects still need to be improved. The standard also needs to be set through a formal policy by the SDI coordinator to compel every local government in using the same standard. Otherwise, there will be a local standard that locally prevails in a certain area.

**Table 20. Assessment of the use of SDI**

| <b>Indicators</b>                          | <b>SDI Components</b> | <b>Sleman</b> | <b>DI Yogyakarta</b> | <b>Semarang</b> | <b>Central Java</b> | <b>Bangkalan</b> | <b>East Java</b> |
|--|-----------------------|---------------|----------------------|-----------------|---------------------|------------------|------------------|
| Awareness of SDI                           | people                | Medium        | Medium               | Low (+)         | High (-)            | Medium           | Medium           |
| Data availability                          | access network        | Low (+)       | Medium               | Low (+)         | Medium              | Low (+)          | Medium           |
| Data sharing accessibility                 | policy                | Low (+)       | Medium               | Low (+)         | Medium              | Medium           | Medium           |
| Relevance to local planning                | data                  | Medium        | Low (+)              | Medium          | Medium              | Medium           | Medium           |
| Data standard and ease of data integration | standard              | Medium        | High                 | High            | High                | Medium           | Medium           |
| The effect on decision making process      | people                | High (-)      | High                 | High (-)        | High (-)            | High (-)         | High (-)         |
| Local cooperation and coordination         | policy                | High          | Medium               | High            | Medium              | High             | High             |
| Formal policy                              | policy                | High (-)      | High                 | Medium          | High (-)            | Medium           | High             |
| Implementation capacity                    | people                | Medium        | Medium               | Low             | High (-)            | Medium           | Medium           |

## 6. Discussions

During the observation, 3 (three) interesting remarks were found. First, spatial information is regarded as a valuable asset by the central government agencies. Some central government agencies require data users, including the local government, to spend some amount of money to have their spatial datasets. Second, some of the local governments has developed local spatial data network. The local spatial data network so far has assisted local government in formulating spatial planning. Third, Bakosurtanal has done their best in supporting spatial planning in Indonesia indeed. However, the local government considered that the role of Bakosurtanal in supporting spatial planning can be improved. This chapter discusses the actual condition and interesting remarks that are found in the field.

### 6.1. Spatial information value

Before discussing the value of spatial information, spatial information flows for local planning shall be presented. The interviews have given a guideline regarding where the local government obtain spatial data for local planning. The information flows are more complex than main land information flows illustrated by de Vries (2006). The information flows can be seen in figure 6. The dashed line indicates little information exchange, while thick line indicates a lot of information exchange.

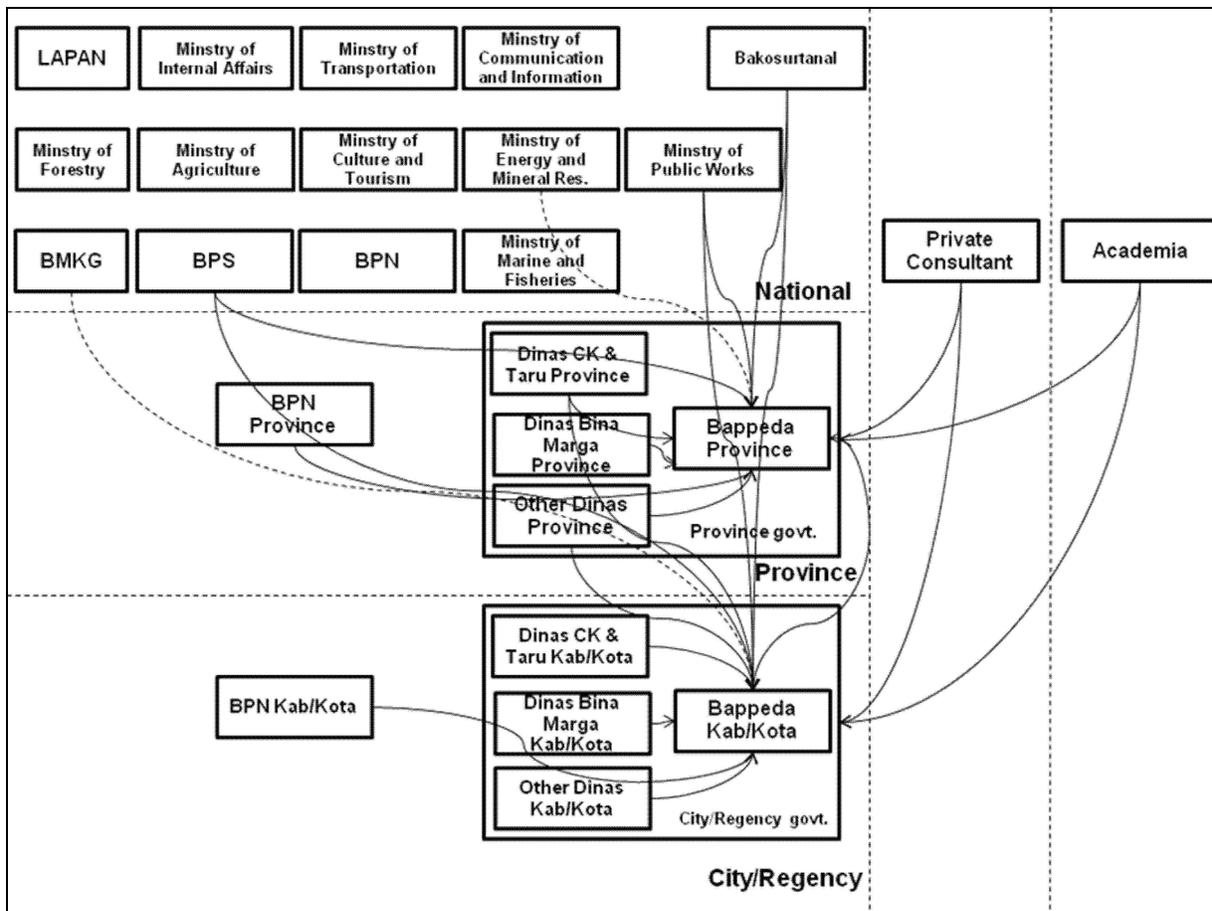


Figure 7. Spatial information flows for local planning

Spatial data for local planning can be obtained from 4 (four) sources of information. First, local government can acquire required spatial data from national SDI nodes as illustrated in table 3. Second, other government agencies support spatial planning arrangements by supplying the needed spatial data to local government. This mechanism works vertically and horizontally. For example, Bappeko Bangkalan got required spatial data from Bappeda East Java (vertically) or Bappeko Semarang obtained the data from Dinas PU Semarang (Public Works Agency of Semarang). Third, local government is also assisted by academia in the provision of spatial data for local planning. Lastly, private consultant that helped local government in formulating spatial planning also provided the needed spatial data.

The spatial data results from land surveying and mapping activities or satellite image. While most of SDI nodes and other local government agencies obtained the data from land surveying and mapping activities, private consultant and academia purchase high accuracy satellite image in order to provide spatial data for local planning. The land surveying and mapping activities are financed by government fund. Usually the local government does not have to pay the needed spatial data from national SDI nodes or other local government agencies. However, our informants also professed that they have to purchase thematic spatial data from Bakosurtanal, the coordinator of national SDI. This policy is supported by law. Therefore, some of them decided to make the required spatial data themselves, e.g. DI Yogyakarta. On the other hand, since private consultant and academia have to spend some amount of money in obtaining high accuracy satellite image, the local government must buy the needed spatial data from them as transaction cost.

One problem that hinders the local government to use spatial data from SDI nodes (the central government agencies), e.g. Bakosurtanal, is that the local government must pay the large amount of money to the central government agencies for obtaining thematic spatial data. Some of these central government agencies have developed a geo-portal but the internet connection is not quite well. Thus, the local government has to go to the central government agencies office to obtain the spatial data by CD/DVD. Later, the local government still has to process the spatial data before using it for local planning. On other hand, the local government does not have enough the human resources that can process the spatial data. Thus, the local government prefers to hire private consultant in spatial planning arrangements since the consultant assists the local government in the entire process of local spatial planning including in spatial data provision.

## **6.2. The development of local spatial data network**

Some of the local governments are developing local spatial data network. Two reasons are behind the development of local spatial data network. First, local spatial data network is mandated by Presidential Decree No.85 of 2007. According to this law, every local government either provincial government or city/regency government has to establish local spatial data network that connects to national spatial data network. The local spatial data network shall be one of the components of national SDI. Second, the local government wants to ensure spatial data provision for their needs. As mentioned, not all spatial data provided by SDI nodes are appropriate for the local government needs.

The development of local spatial data network has encouraged the development of SDI in Indonesia. The local government agencies would be more aware of SDI concepts. Since they work with the local spatial data network, the local government agencies will gain more knowledge about SDI and its purpose. Furthermore, local spatial data network would increase

spatial data exchange efficiency through its access network. Thus, it would support the provision of spatial data within that area.

The development of local spatial data network however still faces 2 (two) main problems. First, some of the local government agencies that shall support the local spatial data network do not seem enthusiastic to support local spatial data network. For this reason, the development of local spatial data network is still put on hold. Additionally, only a few of the local government have built an adequate access network. Second, the local government has not developed data standard. So far, they just recommend standard informally, usually based on the used software. Another important aspect regarding to data standard for local planning is the appropriateness of the spatial data. Not all of spatial data that have been made by local government agencies are relevant to spatial planning requirements.

### **6.3. The role of Bakosurtanal in spatial planning arrangements**

Bakosurtanal as SDI coordinator plays important roles in spatial planning arrangements in Indonesia. Borrowing the term of "leadership" by Kok and van Loenen (2005), Bakosurtanal holds the key of SDI development in Indonesia for some reasons. First, their leadership is accepted by all stakeholders. This leadership is also strengthened by government law, i.e. Presidential Decree No.85 of 2007. In spatial planning arrangements this leadership is also supported by Government Regulation No. 10 of 2000. All local governments also point at Bakosurtanal if they are asked which government body or agency that should support them in the development of local spatial data network. Second, in the arrangements of spatial planning every local government should have Bakosurtanal's approval for its spatial data appropriateness. Third, the local governments usually cooperate with Bakosurtanal when conducting GIS training for their human resources.

Currently, Bakosurtanal deals with 2 (two) major problems in supporting SDI development in Indonesia. First, they have no branch in provinces and cities/regencies. This circumstance makes Bakosurtanal has to struggle in carrying out their duties by themselves. Second, only few of the node institutions have established metadata servers and databases which connect to national clearinghouse which is operated by Bakosurtanal (Puntodewo and Nataprawira, 2007).

Nevertheless, there are also 3 (three) conditions that support the role of Bakosurtanal and also SDI development in Indonesia. First, the local governments are starting to develop local spatial data network. Second, there is a large number of geospatial data existing in Indonesia (ibid). Third, central government and private sector support the development of SDI. Central government has passed several laws that are expected to increase the awareness of all stakeholders in SDI development, while private sector has assisted the provision of spatial data.

## 7. Conclusions

In the earlier chapter the use of SDI in spatial planning in Indonesia was explored. The selected method used by this research and the use of SDI in spatial planning are summarized in this chapter. In addition, spatial information value and the development of local SDIs are also discussed. This chapter will conclude the research questions. Each research question will be concluded separately.

The main objective of this research is to assess the use of Spatial Data Infrastructure (SDI) in supporting spatial planning in Indonesia. In section 1.2 the following research questions were raised to configure the observation:

1. How to assess the use of SDI in supporting spatial planning?
2. What is the use of SDI in supporting spatial planning in Indonesia?

The answers to these questions, which have been presented earlier, are concluded below. In addition some suggestions for further research are presented.

### ***How to assess the use of SDI in supporting spatial planning?***

Some assessment methods can be selected for assessing the use of SDI in spatial planning. Before selecting the appropriate method, criteria of selection shall be developed. For this research, some parts of SMART and SPICED indicators as seen in table 6 were chosen as the criteria of selection. Each indicator was defined to enable the measurement. These assessment methods were then confronted with the criteria of selection. As a result, an evaluation matrix displaying the assessment methods against the criteria of selection was presented in table 7. Based on the evaluation matrix, the appropriate method can be picked. In this research, a method conducted by Nedovic-Budic et al. (2004) was adapted. Two indicators, i.e. formal policy and implementation capacity, are added. Formal policy was added since the awareness and the opinion of the local government to the regulation that support the use of SDI in spatial planning need to be examined. The implementation capacity is also included since at the local level of Indonesia the human resources in geo-information field are scarce and may impede the use of SDI in spatial planning in Indonesia.

### ***What is the use of SDI in supporting spatial planning in Indonesia?***

According to our research, 4 (four) indicators effectively support the use of SDI in spatial planning in Indonesia; i.e. data standard and ease of data integration, the effect on decision making process, local cooperation and coordination, and formal policy. On the other hand, only 3 (three) SDI components (policy, standard and people) support spatial planning arrangements although some people and policy aspects have yet to be improved. The provincial governments have utilized SDI for their needs better than the urban government. The central government agencies that are responsible as SDI nodes should pay more attention on the improvement of access network and data sharing policy to encourage the use of SDI in spatial planning by the local governments. The communication channel between the local government and SDI networks shall also be improved so that SDI networks can provide more relevant spatial data needed for spatial planning.

## 8. Recommendations

In chapter 6, some interesting remarks and issues have been presented. The issues need to be taken into consideration by the local governments and Bakosurtanal. This chapter discusses several suggestions that can be carried out by the local governments and Bakosurtanal in order to address the issues.

First, in order to increase the use of SDI in spatial planning, the central government agencies/ministries should reduce the transaction cost paid by the local government to acquire thematic spatial data. According to our interviews, the local government might use the spatial data if the cost is efficient enough. The human resources of the local government also need to be enhanced. The local government together with Bakosurtanal as SDI coordinator should increase the number of GIS training for the local resources. The local government can also ask the hired private consultant to transfer his/her knowledge to the local resources. It is expected that if the access network is well-developed, the level of knowledge of the local resources are advanced and the transaction cost between local government and government agencies is cheap, the use of SDI in spatial planning would be better.

Second, there are 2 (two) things that can be done to address the problems impeding the development of local spatial data network. First, the local government can adopt the same technology developed by national SDI in the development of local spatial data network (Puntodewo and Nataprawira, 2007). Each metadata database will be gathered, stored and preserved in each data producer. These metadata databases are then interconnected configuring a network. The network is also equipped with additional metadata gateway server that connects to other networks, such as national SDI nodes. They can also encourage any strategic local agencies, called "Dinas", to develop geo-spatial metadata databases under their control. Second, the local government should publish a guideline as a directive that leads strategic local agencies to produce relevant spatial data which is suitable to the requirements of local planning.

Third, using 3 (three) conditions explained in sub-chapter 5.3, Bakosurtanal can use local spatial data network to communicate with local government. Moreover, local spatial data network can be used to disseminate SDI policy. Thus, local spatial data network would not only benefit the local government, but also Bakosurtanal and the nodes institutions. The private sectors can also participate in the development of SDI. For instance, they can assist the node institutions in establishing metadata servers and databases using Public Private Partnership (PPP). They can also help the node institutions in collecting and managing the existing geospatial data. Afterwards, the metadata servers and databases of all SDI nodes including the metadata servers and databases of Bakosurtanal can be interconnected.

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## Appendix 1. Guiding Questions for Interviews

| Criterion   | Question   | Possible Answers  |
|---|--|---|
| Awareness   | Have you ever visited National clearinghouse or geo-portals? E.g: Bakosurtanal's site and ISDN site (www.ina-sdi.or.id).                           | 1. Yes, often   |
|   |  | 2. Yes, at least at once  |
|   |  | 3. Never.   |
|   | Is it easy to find national clearinghouse or geo-portals?  | 1. Yes, very easy to find;  |
|   |  | 2. I found it with a lot of efforts;  |
|   |  | 3. No, I did not find it.   |
|   | Bakosurtanal is national spatial data network coordinator according to Geospatial Information Law. How often do you communicate with Bakosurtanal? | 1. At least every 3 months/ in BKPRD meeting.   |
|   |  | 2. At once during substantial approval for map used for spatial planning formulation.                           |
|   |  | 3. Others, ...  |
|   | Have you ever heard National SDI?  | 1. Yes, I know it and work with it;   |
| 2. Yes, I've ever heard it;   |  |   |
| 3. No, I do not know it at all.   |  |   |
| How often do you use spatial data produced by Bakosurtanal or other national geo-portals? | 1. Almost every time I work with spatial data;   |   |
|   | 2. Only when need it;  |   |
|   | 3. Never.  |   |
| Data availability   | Where did you get spatial data needed for spatial planning arrangements?   | 1. NSDI coordinator (Bakosurtanal);   |
|   |  | 2. Other central government agencies (PU pusat, LAPAN, LIPI, dsb.);   |
|   |  | 3. Local government agencies either vertically or horizontally (Bappeda, Dinas Cipta Karya & Taru/PUESDM, etc.) |
|   |  | 4. I create by myself (including through private consultant or other third parties).                            |
|   |  | 5. Others.  |

|  |   |  |
|--|---|--|
|  | How did you get the spatial data?   | 1. From geo-portals or internet;   |
|  |   | 2. I sent a request and obtained the spatial data via email;   |
|  |   | 3. I got it traditionally via CD/DVD.  |
|  |   | 4. Other...  |
|  |   |  |
|  | Do you create, produce and distribute your own spatial data?  | 1. Yes, I created, produced and use my own spatial data and never use spatial data from other parties.         |
|  |   | 2. Yes, but only occasionally to complement spatial datasets I have from other parties (NCASM or contractors); |
|  |   | 3. No, I never created and produced spatial data for my work;  |
| <b>Data sharing accessibility</b>  | Is there any regulation from the chairman of your institution that arranges of how to obtain spatial data for local planning? | 1. Yes, the legal basis has been already enacted;  |
|  |   | 2. Yes, but it is still on process;  |
|  |   | 3. No, there is no a legal basis.  |
|  |   |  |
| Is there any agreement/law/contract (MoU, national regulation, etc.) between your institution and Bakosurtanal or other central government agencies that organizes of how to access and obtain spatial data? | 1. Yes, there is national regulation to make the data available (law, decree, executive government decision, etc.);           |  |
|  | 2. Yes, there is a contract between NCASM and my office;  |  |
|  | 3. No, we got the spatial data by informal way, e.g. individual request or informal agreement.                                |  |
| Can you access spatial data of Bakosurtanal freely?  | 1. Yes, I can access the spatial data without any specific conditions;  |  |
|  | 2. Some or a specific spatial data needs specific requirements;   |  |
|  | 3. No, I need a request to NCASM every time I try to access the spatial data.   |  |

|  |  |  |   |
|--|--|--|---|
|  | Do you have to pay spatial data which is obtained from Bakosurtanal?                                       | 1. All spatial data are free;<br>2. I have to pay a custom tailored spatial data;<br>3. I have to pay all spatial data I got.  |   |
|  | Are you willing to share your spatial data with other government institutions?                             | 1. Yes, all my datasets is available for other government agencies;<br>2. Some datasets are unavailable;<br>3. No, I never share my datasets. (Why?)   |   |
|  | Are there any conditions that you apply when sharing your spatial data with other government institutions? | 1. No, I do not it apply it.<br>2. Not applicable by law (including local regulation);<br>3. Yes, I do. Other agencies who need my datasets should agree the term and conditions;  |   |
|  | What are the conditions (if any)?  | <input type="radio"/> Data used for requested purpose and not shared with others without permission<br><input type="radio"/> No guarantee of format, copyright, no resell or redistribution via web; no responsibility for manipulated data;<br><input type="radio"/> No further distribution<br><input type="radio"/> Data can be used for requested purpose without our permission (only JPEG)<br><input type="radio"/> Other, ... |   |
|  | What is the reason hindering you in sharing spatial data?  | <input type="radio"/> Economic protection<br><input type="radio"/> Maintain data distribution control<br><input type="radio"/> Avoid data misuse   |   |
|  |  |  |   |
|  | <b>Relevance to national planning</b>  | According to Government Regulation No.15/2010, there are at least 8 (eight) spatial data required for spatial planning arrangements. Based on your experience, how many are provided by SDI nodes including Bakosurtanal?  | 1. All of them/8 (eight);<br>2. 4-6;<br>3. Less than 4. |
|  |  |  |   |
|  |  |  |   |
|  |  |  |   |
|  |  |  |   |

|   |  |  |
|---|--|--|
|   | Of spatial data provided by SDI nodes, how many are used by your institution for local planning?   | 1. All of them;  |
|   |  | 2. More than 1, but not all of them;                             |
|   |  | 3. None.   |
|   | Is the scale of spatial data obtained from SDI nodes the same as the appropriate scale mandated by Spatial Planning Act or other relevant regulations, e.g. Gov't Regulation No.10/2000? | 1. Yes, and I can use it without any modifications;              |
|   |  | 2. No, therefore I need to modify it a little bit;               |
|   |  | 3. No, I could not use it at all.                                |
|   | Does the content of the spatial data conform to your needs (local planning)?   | 1. Yes, the contents conform to my requirements;                 |
|   |  | 2. No, I need to modify it a little bit;                         |
|   |  | 3. No, I could not use it at all.                                |
|   | How is the metadata of the spatial data obtained from SDI nodes?   | 1. Yes, the metadata is clear enough;                            |
|   |  | 2. Yes, the metadata is not too clear but I can still use it;    |
|   |  | 3. I did not find it at all.                                     |
| Do you use the metadata as well?                  | 1. Yes, I used it;   |  |
|   | 2. Yes, but I only certain information from the metadata (i.e. the validity date, the scale and accuracy, etc.);   |  |
|   | 3. No, I never used it.  |  |
| <b>Data standard and ease of data integration</b> | Do you have to re-modify/adjust spatial data obtained from SDI nodes when you use it?  | 1. No, they can use right away;                                  |
|   |  | 2. Yes, but not too often;                                       |
|   |  | 3. Yes, they have to make a lot of modification before using it. |
|   | What is the file format of your spatial data?  | 1. SHP;  |
|   |  | 2. DXF;  |
|   |  | 3. Others..... ( <i>mention it</i> )                             |
|   | Does the spatial data from SDI nodes use the same format as yours?   | 1. Yes, all the datasets are using the same standard;            |
|   |  | 2. Only some of them;  |
|   |  | 3. No, the data mostly use different format.                     |

|  |   |   |
|--|---|---|
| <b>The effect on decision making process</b>                               | Who is the user of information brought by the output of spatial analysis?   | 1. All organization entity.   |
|  |   | 2. Management level and spatial planning dept.  |
|  |   | 3. Spatial planning department.   |
|  | What is the relationship between the decision and spatial analysis output in local planning?  | 1. Needed, decision cannot be made without it;  |
|  |   | 2. Desirable, decision may be made with or without it;                                  |
|  |   | 3. Extraneous, the decision will be made anyway.  |
|  | Does spatial data obtained from SDI nodes support your work in arranging spatial planning?  | 1. Yes, they do;  |
|  |   | 2. No, it only supports certain parts of the process that being done;                   |
|  |   | 3. No, I think other spatial datasets are more useful.                                  |
|  | What is the contribution of spatial data to your organization?  | 1. Spatial datasets are indispensable and integral part of the organization activities; |
|  | 2. Spatial data increase the efficiency and quality of information management;  |   |
|  | 3. They offer little added value compared with paper information.   |   |
| How does the decision maker in your organization think about spatial data? | 1. Spatial data are mentioned in policy plan and organizational strategies;   |   |
|  | 2. Spatial data are only viewed as additional data to support the organization tasks;   |   |
|  | 3. They do not expect much good to come from spatial data application.  |   |
| <b>Local cooperation and coordination</b>                                  | Do you always invite Bakosurtanal as SDI coordinator to discuss your spatial analysis result in spatial planning arrangement processes? | 1. Yes, in every single step;   |
|  |   | 2. Only on a specific step; mention some ...  |
|  |   | 3. Never.   |
|  | Do you conduct coordination with other government institutions in spatial data provision?   | 1. Yes, we do ;   |
|  |   | 2. Yes, but we are not the coordinator;   |
|  | 3. No, we do it by ourselves.   |   |

|                                |   |  |
|--------------------------------|---|--|
|                                | In which spatial data provision process(es) do you carry out coordination with other government institutions?                         | <input type="radio"/> Data collection process<br><input type="radio"/> Maintenance process<br><input type="radio"/> Use of the datasets<br><input type="radio"/>   |
| <b>Formal policy</b>           | Have you ever heard about Gov't Regulation No.10/2000 about Map Accuracy?   | 1. Yes, I know it very well;<br>2. Yes, I've ever heard it;<br>3. No, I do not know it at all.   |
|                                | What is your opinion regarding Gov't Regulation No.10/2000 about Map Accuracy?  | 1. Need some improvement;<br>2. Adequate enough;<br>3. Never heard about it.   |
|                                | Which part of the regulation needs improvements if any?   | <input type="radio"/> Data standard arrangements<br><input type="radio"/> Metadata arrangements<br><input type="radio"/> Data sharing arrangements<br><input type="radio"/> Others, .... ( <i>mention</i> )  |
|                                | Does the provincial government also publish local law that regulates the use of certain spatial data especially for local planning?   | 1. Yes, there is;<br>2. Yes, but we still try to formulate it;<br>3. No, there is not;   |
|                                | Does the city/regency government also publish local law that regulates the use of certain spatial data especially for local planning? | 1. Yes, there is;<br>2. Yes, but we still try to formulate it;<br>3. No, there is not;   |
|                                |   |  |
| <b>Implementation capacity</b> | How do you assign your GIS experts when dealing with spatial planning arrangements?   | 1. We assigned our GIS experts exclusively in spatial planning unit. Each of them has special task.<br>2. We assigned our GIS experts exclusively in spatial planning unit. No specialization of task for them.<br>3. Our GIS experts are also responsible for the GIS matters in the organization.<br>4. Other... |

|  |  |  |
|--|--|--|
|  | What kinds of software used by your GIS experts to support their work? | o ArcView 3.2.   |
|  |  | o ArcGIS   |
|  |  | o AutoCAD  |
|  |  | o Others, .... (mention)   |
|  | What is your GIS expert(s) background?                                 | 1. Our experts has GIS background in their past study. They also have working experience beforehand. |
|  |  | 2. Our experts' is GIS fresh graduate.   |
|  |  | 3. Our experts' background is spatial planning.  |
|  |  | 4. Others...   |

## Appendix 2. List of Abbreviations

| <b>Terms</b>      | <b>Indonesia Abbreviations</b>                      | <b>English Abbreviations</b>                               |
|-------------------|---|--|
| NSDI              | -   | National Spatial Data Infrastructure                       |
| Bakosurtanal      | Badan Koordinasi Survey dan Pemetaan Nasional       | National Coordinating Agency for Surveys and Mapping       |
| Bappekab          | Badan Perencanaan Pembangunan Kabupaten             | Regency Planning Development Agency                        |
| Bappeko           | Badan Perencanaan Pembangunan Kota                  | City Planning Development Agency                           |
| Bappeda           | Badan Perencanaan Pembangunan Daerah                | Local Planning Development Agency                          |
| Dinas PU dan ESDM | Dinas Pekerjaan Umum dan Energi Sumber Daya Mineral | Local Agency of Public Works, Energy and Mineral Resources |
| Dinas CK dan Taru | Dinas Cipta Karya dan Tata Ruang                    | Local Planning and Housing Agency                          |
| BPN               | Badan Pertanahan Nasional                           | National Land and Cadastre Agency                          |
| BPS               | Badan Pusat Statistik                               | Statistics Central Agency                                  |
| BMKG              | Badan Meteorologi, Klimatologi dan Geofisika        | Climatology, Meteorology and Geophysics Agency             |
| LAPAN             | Lembaga Penerbangan dan Antariksa Nasional          | National Outer Space and Aviation Agency                   |

### Appendix 3. List of Interviewed Organizations

| No. | Organization                           | Address                                 | Scope    | Area          | Position   | Interviewee                 | Date of interview |
|-----|--|---|----------|---------------|--|-----------------------------|-------------------|
| 1   | Bappekab Sleman                        | Jl. Parasamya No.1, Beran, Sleman       | Regency  | Sleman        | Head of City Planning Dept.  | Kunto Riyadi                | 24/1/2012         |
|     |  |   |          |               | Operational Staff  | Abdur Rahman                | 27/1/2012         |
| 2   | Dinas PU dan ESDM Provinsi Yogyakarta  | Jl. Bumijo No. 5, Yogyakarta            | Province | DI Yogyakarta | Head of Spatial Planning Dept.   | Hananto Hadi Purnomo        | 25/1/2012         |
|     |  |   |          |               | Head of Spatial Planning Arrangements Sector   | Yusi Rosnidar               | 25/1/2012         |
|     |  |   |          |               | Operational Staff  | Wawan                       | 25/1/2012         |
| 3   | Bappeda Provinsi DI Yogyakarta         | Komplek Kepatihan Danurejan, Yogyakarta | Province | DI Yogyakarta | Head of Transportation, Spatial Planning, Housing, Energy and Mineral Resources Sector | Ni Made Dwipanti Indrayanti | 26/1/2012         |
|     |  |   |          |               | Operational Staff  | Dzulhanif Harahap           | 26/1/2012         |
| 4   | Dinas CK dan Taru Provinsi Jawa Tengah | Jl. Madukoro Blok AA BB, Semarang       | Province | Central Java  | Head of Spatial Planning and Land Use Dept.  | Sigit Krida Hariono         | 30/1/2012         |
|     |  |   |          |               | Operational Staff  | Harjadi                     | 31/1/2012         |
| 5   | Bappeda Provinsi Jawa Tengah           | Jl. Pemuda 127-133, Semarang            | Province | Central Java  | Head of Regional Development Sector  | Hardo Wibowo Santoso        | 1/2/2012          |
|     |  |   |          |               | Operational Staff  | Tri Widodo                  | 2/2/2012          |
| 6   | Bappeko Semarang                       | Jl. Pemuda 148, Semarang                | City     | Semarang      | Head of Spatial Planning and Environment Sector  | Budi Prakosa                | 6/2/2012          |
|     |  |   |          |               | Operational Staff  | Lutfi                       | 7/2/2012          |
| 7   | Bappeko Bangkalan                      | Jl. Soekarno - Hatta No. 35, Bangkalan  | City     | Bangkalan     | Head of Physics and Infrastructure Dept.   | Eko S.                      | 9/2/2012          |
|     |  |   |          |               | Head of Spatial Planning Sector  | Alifin                      | 10/2/2012         |
| 8   | Bappeda Provinsi Jawa Timur            | Jl. Pahlawan No. 102 - 108, Surabaya    | Province | East Java     | Head of Regional Infrastructure Dept.  | Tiat Surtiat                | 15/2/2012         |
|     |  |   |          |               | Operational Staff  | Iman                        | 16/2/2012         |
|     |  |   |          |               | Operational Staff  | Sandy                       | 17/2/2012         |
| 9   | Dinas CK dan Taru Provinsi Jawa Timur  | Jl. Gayung Kebonsari no. 169, Surabaya  | Province | East Java     | Head of Spatial Planning Dept.   | Endah Anggraeni             | 20/2/2012         |
|     |  |   |          |               | Operational Staff  | Oni                         | 21/2/2012         |