I-SRI, an SDI Readiness Index for Local Government in Indonesia

Heri SUTANTA, Trias ADITYA, Purnama SANTOSA, DIYONO, Dany LAKSONO and Annisa FARIDA, Indonesia

Key words: SDI readiness index, local government, assessment, Indonesia

SUMMARY

Developing SDI at local government level faces different challenges than that of at the central government. While there are fewer impediments at the central government level, the situation commonly found at many local governments is far from ideal. They encountered various problems such as the availability of qualified personnel, good IT infrastructure, availability of reliable internet network and subscription, clear vision and support from the district leaders, and lack of spatial data. To overcome these problems, firstly a thorough assessment on the SDI readiness needs to be conducted. We propose I-SRI, Indonesian SDI Readiness Index as a measure for local government in Indonesia.

The aim of I-SRI is to portray the current status of SDI readiness and implementation at the district/city and provincial government in Indonesia. The index resulted would be beneficial for developing policy for appropriately providing assistance for those who need most and awarding recognitions for those who perform well. Such index should portray all aspects of SDI: policy and institutional aspect, human resources, technology, and spatial data availability.

In the I-SRI, these four aspects were elaborated into more detailed sub-components of pre-requisites element of readiness. Each sub-component was then assigned individual weight based on their importance. Similarly, the main components were also assigned individual weight. The weights of the main and sub-components were determined using expert judgment method based three separate workshops. Finally, the indexes were obtained by summing all the multiplication results of the weight of the main components and sub-components and then normalize them to obtain a value of 0 to 100. This paper presents the method to develop the I-SRI and the initial findings for some districts/cities and provinces in Indonesia.

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1. INTRODUCTION

Spatial Data Infrastructure (SDI) has been developed and implemented for around twenty years. High expectations were put SDI to overcome many existing problems on geospatial information management, such as duplication of efforts, minimal use of existing data, difficulties in assessing and accessing data, as well as transparency and accountability of development activities. SDI is expected to benefit various application domain, such as disaster managemen (Mansourian & Rajabifard, 2006), land administration (Williamson et al. 2007), and spatial planning (Nedovic-Budic *et al.* 2004).

Although SDI has been implemented successfully for some times at national level, the successfulness of implementation at local government level was varied. A number of factors influence the readiness of local government to implement SDI. Evaluation of the existing situation prior to full scale implementation is a pre-requisite. By evaluation, readiness level of a particular local government can be portrayed. Readiness index is relevant for drafting required policy to accelerate SDI development. Similar readiness indexes have been developed, such as e-Government readiness index (DESA, 2008) or e-readiness index developed by The Economist Intelligence Unit (the Economist, 2009).

In SDI, SDI readiness index have also been a subject of many studies, such as, Delgado Fernandez et al, (2008); Crompvoets & Breg (2008); Eelderink et al., (2008), and Giff & Jackson (2013). Most of the assessment methods presented in the previous research were directed toward national government. Development of SDI at local and central government have distinct characteristics which make assessment methods for national SDI need to be modified.

Developing SDI at local government level faces different challenges than that of at the central government. While there are fewer impediments at the central government level, the situation commonly found at many local governments is far from ideal. They encountered various problems such as the availability of qualified personnel, good IT infrastructure, availability of reliable internet network and subscription, clear vision and support from the district leaders, and lack of spatial data. However, at this stage there is no established mechanism for evaluating SDI readiness at the local government level. The absence of such evaluation hindering the development of appropriate policy on providing assisstance. In effect, central government assisstance were based on who submit proposal first or for who are known to officials of the national mapping agencies. This situation is affecting the effectivenes of developing local SDI as well as inadvertently giving different treatment for local governments.

To overcome these problems, a thorough assessment on the SDI readiness needs to be conducted. This research aimed to address the situation by developing a method for assessing SDI readiness at the local government level, particularyly in Indonesian setting. The method was made as simple as possible in order to enable local government official to conduct a self assessment. This would make them aware of their readiness and able to develop a policy and action to overcome their weaknesses. On the other hand, national government would be benefited by obtaining portrays of current status and recent development. This paper presents the background, method and preliminary finding on the evaluation of SDI readiness index for some local governments in Indonesia. The method was named as I-SRI, Indonesian SDI Readiness Index, an assessment tool for local government SDI in Indonesia.

2. SDI DEVELOPMENT IN INDONESIA

2.1 Brief Discussion on SDI

SDI is a framework for sharing and access to spatial data among stakeholders who utilize similar datasets (Rajabifard, Feeney et al. 2002). The goal is to maximize the use of existing spatial data, and reduce duplication in the creation and management of spatial data. SDI facilitating the search and discovery of spatial data located separately in government's institution repository. SDI components are: people, access network, policy, standard, and data (see Figure 1). The relation of these five elements are dynamics.

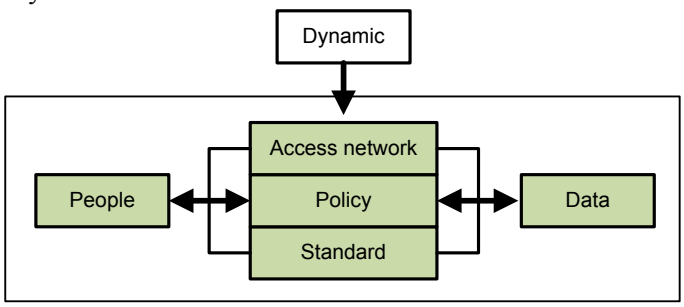

Figure 1. Main components of SDI (Rajabifard et al, 2002)

SDI as an infrastructure is similar to road or electricity network. As an infrastructure, SDI has to be widely available, easy to use, employ a common standard, flexible, and accommodate public interest. The driving factor for SDI development may come from internal requirements as well as external pressures. Interval drives may consist of the need to discover, access and use of geospatial data. External drives may come from globalization, advancement in ICT technology, and public pressures (Rajabifard, Feeney et al. 2002). Many national mapping agencies stated that the main motivation of SDI development is to facilitate development activities to reach people's welfare. In case of spatially-enabled government (SEG) concept, SDI is one of the main component (Kok, Rajabifard et al. 2008; Masser, Rajabifard et al. 2008). In this concept, government is not only managing spatial information, but has to move further to manage information spatially (Williamson, Rajabifard et al. 2007)

2.2 Digital Mapping Activities

The development o SDI in Indonesia started with the creation of digital maps for natural resources management. Several projects were established in 1980s to 1990s to create the digital spatial databases and develop human resources capable of operating GIS software. These include:

1. RePPPRoT (Regional Physical Planning Programme for Transmigration) was executed in 1984-1989 (Rais, 1997; Poniman et al., 2004)
2. RePPMiT (Regional Physical Planning for Map Improvement) which was executed in 1990 – 1994 (Atmadilaga and Sarbini, 2010)
3. Large Scale Maps of 100 Cities and Towns in Indonesia was executed in 1993 – 2001 (Reed, 1995)
4. LREP (Land Resources Evaluation and Planning) project – 1983 – 1990 (ADB, 1996)
5. MREP (Marine Resources Evaluation and Planning) project in 1993 – 1998, which was then followed by MAREMAP (Dahuri, 1997).

These projects resulted in vast amount of digital maps of various themes as well as GIS-ready data. Further, they were not only produce digital map and pioneering staff who would later led digital mapping activities in Indonesia, but also influenced curriculum in universities providing surveying and mapping education. Digital mapping and geographic information system were absorbed as subjects in the curriculum developed in late 1980s or early 1990s.

2.3 Development of National SDI

Started in 1991, Bakosurtanal formalised the national level coordination activities of GIS at various ministerial, government agencies and local government through a series of annual meeting and seminar (Lilywati & Gunarso, 2000). The initiative named as SIGNAS which stands for Sistem Informasi Geografis Nasional (National Geographic Information System). The participants of the meeting were officials from local government, usually from the Regional Planning Agency (Bappeda), and also from the central government agencies. This early activities makes Indonesia classified as one of the early adopters of SDI (Masser, 1999).

In 1999/2000 the initiative's name was changed into Infrastruktur Data Spasial Nasional (IDSN) or National Spatial Data Infrastructure (NSDI) which reflects changes in the viewpoint on SDI. Another change was occured again in 2011, as the consequence of the enactment of Law 4/2011 on Geospatial Information. The Law use the word 'Geospatial information infrastructure' to denote SDI. Consequently, the national coordination meeting was renamed to National Coordination Meeting on Geospatial Information Infrastructure. Year 2011 also become another milestone for SDI development in Indonesia with the launching of the Indonesian geoportal (http://www.tanahair.indonesia.go.id). In this year, the name of BAKOSURTANAL was changed into Badan Informasi Geospasial – BIG (Geospatial Information Agency)

SDI development requires legal foundation to which all policies and directives referred. In 2007, the President of the Republic of Indonesia issued a Presidential Decree no. 85 on the National Spatial Data Network (Jaring Data Spasial Nasional: JDSN). JDSN aimed as a collaborative, integrative and tertib of spatial data sharing among several central government agencies. Local government's SDI was not addressed in this regulation yet. This presidential directive is currently under revision.

2.4 SDI at Local Government Level

The situation at the national level has been improved considerably in recent years largely contributed by the enactment of the Law on Geospatial Information and increased of funding received by BIG. However, at the local government level the SDI development need to be accelerated. Local government has more limitation compared to the central government, especially in the following aspects: human resources, data, technology, organisational arrangement and funding (Sutanta et al, 2010). These issues are resulted from the socio-technical allignment of SDI implementation (De Man, 2006). In addition, until recently, local government may also experienced difficulties in acessing spatial data from some counterparts from the central government organizations. Power relation among local government agencies and data availability (Mansourian, 2005) also hindering SDI implementation.

Since 1999, Indonesia implemented regional autonomy with district/city having greater authority and responsibility. In this regard, they must be empowered to make development becoming more effective and sustanainable. As has been said by many researchers (i.e. O'Looney, 2000), geospatial information played an important role in local government decision making. Therefore, good geospatial information and governance will facilitate better-informed decision making at the forefront of local government.

There are some issues and challenges facing SDI development, including internet network, user limitation, institutional arrangement, staffing, access policy, information policy, ICT infrastructures, software and licensing (Kok, et al., 2007). In addition, in Indonesian case there are other issues such as stakeholders' awareness and involvement, availability of geospatial data, and local government's role (Sutanta et al., 2010).

3. ASSESSING LOCAL GOVERNMENT'S SDI, PRELIMINARY RESULTS

3.1 SDI Assessment Method

SDI assessment methods have been the subjects of researches for quite sometimes. In general, two types of assessments were employed on SDI: assessing the readiness and assessing the implementation. Readiness denote the situation whereby a country or region is ready to implement SDI, while assessment on the performance evaluation the implementation of SDI. Each category has several methods, as has been elaborated by Giff & Jackson (2013) as follow:

Table 1. SDI assessment methods (modified from Giff & Jackson, 2013)

Category	Methods
Readiness	Clearinghouse readiness (Crompvoets & Bregt, 2007).
	Clearinghouse suitability index (Crompvoets & Bregt, 2008).
	SDI readiness index (Fernandez, dkk., 2008).
	INSPIRE State of Play (Vandenbroucke, dkk., 2008)
Performance Assessment	The geoconnection framework (GeoConnections, 2013)
	Geomaturitymodel (SADL, 2010)
	Balance scorecard (Toomanian, dkk., 2011)
	Multi-View Framework (Castelein & Callejo, 2010; Grus, dkk., 2011)

These methods have been tested and applied for a number of regions at the country level. For a country, with different governmental setting, these methods need to be adapted. Specifically if it would be utilized to assess readiness of local SDI at different level. Assessing readiness of SDI implementation in a country will be different from assessing readiness of a subnational government. Province and district/city level have different roles and mandates than that of national government, therefore the assessment methods should also reflect these differences. In line of this, this paper explain the assessment method for SDI readiness at local government level in Indonesia.

The method is aimed to be simple and be easily understood by local government officials with little knowledge about SDI. They should be able to conduct a self-test to assess their readiness level and subsequently address the problems found. Simple weighting calculation was used.

3.2 First version of I-SRI, Indonesian Spatial Readiness Index

The I-SRI, the Indonesian Spatial Readiness Index, intention is to portray local government readiness in implementing SDI. SDI components, which also indirectly listed in the Law of Geospatial Information, were used as the main category. I-SRI consists of four main aspects: institutional aspect, human resources, technology, and data.

Institutional aspect covers three sub-components, institutional setting, funding, and regulation. Human resources element explores the existing staf quantity, qualification and professional development. Technological component consists of the availability of hardware, software and standard. On the data component, the index evaluates the availability and coverage of the most important dataset in local government. Each component were detailed in the questions.

The weight of the question varies, based on their importance value. The determination of the weight factor was conducted by team from the Research Centre for SDI Development (PPIDS UGM) together with BIG staffs. Each question has different weight. The answer to each question may carry different weight as well. For example, if the number of staffs qualified for operating geospatial server increase, then the score will also increase. Commitment for routine internal funding will have highest score, overtopping non-routine internal funding and funding from the central government. Further, the importance of each main components were also differentiated. The formulae to calculate the index is as follow:

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I-SRI = 1.5 x institutional + 2 x human resources + 1 x technology + 1 x data
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The interim result is then normalized to obtained a final score of 1 – 100.

In the I-SRI, human resources is classified as having the highest importance. They are the one who will design, obtaining funding, operating, managing and developing SDI. They will determine the successfulness of the SDI implementation. The current situation indicate that lack or absent of qualified staff significantly affecting SDI development. Institutional aspect covers three important elements: regulation, funding, and institutional arrangement. These elements will define the sustanainability of SDI implementation, and therefore ranked number two in its importance. Technology and data have similar importance, but less than human resources and institutional aspect. These two aspects depend on the them. Detailed questions for each aspects are listed in the following.

Policy and institutional aspects

1. whether or not a coordination among local government agencies or established committee exist for the development and utilization of geospatial data
2. whether or not a dedicated unit for spatial data management exist
3. a road map for SDI development
4. mechanism for access to spatial data
5. mechanism for spatial data utilization and copy right protection
6. local government regulation on management and utilization of spatial data
7. funding (routine and non-routine) from local government and/or central government for
   a. spatial data provision
   b. system and technology provision
   c. skills and competence upgrading for staff in geospatial information management

Human resources aspect

1. number of personnels able to operate GIS software and manage geospatial information
2. number of personnels able to operate geospatial server
3. number of personnels who manage geospatial information and GIS with respect to qualification:
   a. self learning on GIS and/or web
   b. attending courses on GIS and/or web
   c. holding diploma degree in geodesy/geomatics/geography/IT
   d. holding bachelor degree in geodesy/geomatics/geography/IT
4. capacity building for staff in internet-based GIS and geospatial data management

Technological aspect

1. number of GIS software installed (licenses or open source)
2. number of hardware used for management and dissemination of geospatial information
   a. computers
   b. server
3. implementation of Indonesian National Standard or other nationally recognized standard
4. dedicated internet subscription for geospatial server
5. geoportal is operating
6. catalogues for maps and geospatial information have been established
7. catalogues can be publicly accessed through the internet
8. metadata were incorporated in maps and geospatial databases
9. metadata were used for developing catalogues

Geospatial data aspect

1. geospatial data availability
   a. topographic map
   b. land parcel map
   c. land and building tax map
   d. spatial plan map
   e. transportation/road network
   f. utilities maps
2. maps were stored as digital geospatial databases
3. geospatial data publicly available through the website

3.3 Testing the I-SRI

The index developed was disseminated to evaluate SDI readiness for the whole provinces and portion of districts/cities. Of the 34 provinces, questionnaires were distributed to 33 provinces. Province of North Kalimantan which was just established in 2013 was excluded. 150 districts/cities of the 508 districts/cities in Indonesia were sent the questionnaires. Three methods of distributing the questionnaire were employed:

a. *Testing the questionnaire respondents*. The first version of the questionnaire was distributed to the participants of the Coordination Meeting on SDI conducted by BIG in September 2013. The participants were come from Local Planning Agency at provincial and district/city who received grant from BIG. Feedbacks from respondents were used to refine the wording and structure of the questions, without changing the substance of the questionnaire.

b. *Mailed respondents*. The refined questionnaires were distributed to district/city planning agencies in all provinces. Due to some limitations, questionnaires were distributed to only one fourth to one third of the districts/cities in each provinces.

c. *FGD respondents.* PPIDS UGM conducted two focus group discussion (FGD) and participate in one workshops on developing SDI at local government level in Province of Yogyakarta and Central Java. Questionnaires were distributed to district/city officials attending.

Responses were received from 14 provinces and 34 districts/cities. Some questionnaires were filled in by head of regional planning agencies, but mostly by head of section responsible for geospatial information management. After calculation using the aforementioned formulae, the Indonesian SDI readiness index for provinces and districts/cities were obtained and presented in Table 2 and Table 3.

Tabel 2. SDI readiness index for provinces

No.	Provinsi	index
1	Province #1	59,85
2	Province #2	50,00
3	Province #3	77,27
4	Province #4	29,55
5	Province #5	68,18
6	Province #6	59,85
7	Province #7	27,65
8	Province #8	64,02
9	Province #9	45,83
10	Province #10	20,45
11	Province #11	68,18

Tabel 2. SDI readiness index for districts/cities

No.	Kabupaten/Kota	index	No	Kabupaten/Kota	index
1	District #1	42,80	18	District #18	18,18
2	District #2	59,85	19	District #19	16,67
3	District #3	30,68	20	District #20	15,15
4	District #4	55,68	21	District #21	18,94
5	District #5	45,08	22	District #22	18,56
6	District #6	8,33	23	District #23	76,52
7	District #7	38,64	24	District #24	12,88
8	District #8	46,21	25	District #25	27,27
9	District #9	28,30	26	District #26	52,27
10	District #10	29,92	27	City #1	42,05
11	District #11	43,18	28	City #2	83,71
12	District #12	51,14	29	City #3	56,06
13	District #13	49,24	30	City #4	35,23
14	District #14	39,39	31	City #5	34,47
15	District #15	34,09	32	City #6	33,33
16	District #16	6,06	33	City #7	54,17
17	District #17	34,09	34	City #8	42,80

The index shows that on the average scores for provinces and districts/cities were relatively low, 51.90 for provinces and 37.06 for districts/cities. Provinces are more ready than districts/cities. In more detail assessment of district/city level, cities have higher average score of 48.53 compared to 34.58 of the districts. The highest and lowest score of cities (83.71 and 33.33) are still higher than that of the districts (76.52 and 6.06).

Observation on the scores obtained shows that the index is comparable to the relative wealth of province and district/city. The closeness to the centre for information and expertise is also affecting the development of local SDI. The Indonesian SDI Index for local government, in its first version, is able to portray the capacity of provincial and district/city government to implement SDI. The questionnaire has been included in the guide book on local SDI development published by BIG. The book was disseminated to local governments in Indonesia.

4. CONCLUSION AND FUTURE WORKS

This paper presents a finding of an effort to develop an SDI Readiness Index for local government in Indonesia (I-SRI). The index has been tested and used to evaluate the readiness of provincial and district/city government. The index is made as simple as possible, in order to enable local government official to use it. They can use it as a self-evaluation tool to investigate which elements of local SDI require improvement. Nonetheless, the index has covered the fundamental elements required to develop SDI at local government level in Indonesia.

To response to the changing environment in the future, I-SRI will be adapted and expanded. Assessment for SDI readiness index for the whole local district/city in Indonesia is planned.

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BIOGRAPHICAL NOTES
Heri Sutanta obtained his B.Eng. from University Gadjah Mada, MSc from ITC and PhD from the University of Melbourne. He joined the Department of Geodetic Engineering as lecturer in 2002. He teaches GIS, Applied GIS, and Spatial Data Infrastructure. He is currently the Director of the Research Centre for SDI Development (PPIDS) of the University Gadjah Mada and Deputy Head of Postgraduate Program in Geomatics, University Gadjah Mada.
Trias Aditya obtained his B.Eng. from University Gadjah Mada, MSc from ITC and PhD from the University of Utrecth the Netherlands. He joined the Department of Geodetic Engineering as lecturer in 2002. He is currently the Deputy Head of the Department of Geodetic Engineering and researcher at PPIDS of the University Gadjah Mada.
Purnama Budi Santosa obtained his B.Eng. from University Gadjah Mada, MSc from the University of Melbourne and Dr. Eng. From the University of Kyushu. He is lecturer and researcher at the Department of Geodetic Engineering and . He is lecturer at the Department of Geodetic Engineering and researcher at the Research Centre for SDI Development (PPIDS) of the University Gadjah Mada.
Diyono obtained his B.Eng. from University Gadjah Mada, his M.Eng. from ITB and is currently a PhD student at the Department of Geodetic Engineering. His research focus is on the development of assessment framewrok for spatial data interoperability.
Dany Laksono obtained his B.Eng. from Gadjah Mada University. He is currently serving as teaching assisstant at the Department of Geodetic Engineering and research assisstant at PPIDS.
Annisa Farida is a M.Eng. student in Geomatics, University Gadjah Mada. Her research interests are on SDI and Spatially-enabled Government.

CONTACTS

Dr. Heri Sutanta
Research Centre for SDI Development (PPIDS)
Department of Geodetic Engineering, Faculty of Engineering
Universitas Gadjah Mada
Jl. Grafika no. 2, Yogyakarta
Indonesia
Tel. +62 274 6492121
Email: herisutanta@ugm.ac.id
Web site: http://www.ppids.ft.ugm.ac.id