Enhancing Democracy in Spatial Planning Through Spatial Data Sharing in Indonesia

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ABSTRACT

In the current era of open data in Indonesia, spatial mapping methods have changed from paper-based to digital formats. Today, government institutions, business enterprises and citizens in Indonesia create and share spatial data to present geographic information in particular areas for socio-economic applications, including spatial planning. This situation provides the context for the research reported here.

This study emerged during the development of a policy focused on national spatial data sharing in Indonesia. The policy intends to achieve the integration of spatial planning programmes at national, provincial, municipality (*kota*) and regency (*kabupaten*) levels, with a 'One Map Policy' (OMP). This concept suggests merging geographic information to create a unified system of basic and national thematic geographic information. Furthermore, the idea of the 'One Map Policy' does not only consider the technical aspects of spatial data infrastructure, but also non-technical Geographic Information System (GIS) matters, such as strategic management, human resource capacity and institutional collaboration.

One way of achieving spatial planning coherence is dialogue between policy makers and the public. The dialogue can be built through spatial data sharing between official and crowd-sourced data. Technical aspects important for achieving spatial planning programmes consensus in both these cases, but non-technical issues, such as social, political, economic, institutional, assurance, and leadership factors are also critical. Therefore, this thesis proposes the SPATIAL framework, which stands for ***S****ocial interactionism,* ***P****olitical will,* ***A****ccounting,* ***T****echnological artefacts,* ***I****nstitution,* ***A****ssurance and reward,* as well as ***L****eadership and legitimacy*. Furthermore, to enhance democracy in spatial data and information sharing in the spatial planning context, the researcher developed the SPATIAL framework using three models, viz. *i*) the organisational willingness model to share spatial data within the Spatial Data Infrastructure (SDI) and Volunteered Geographic Information (VGI) context; *ii*) the community participation stepped model for government agencies; and *iii*) the socio-technical model of SDI and VGI integration in the spatial planning context.

Ultimately, the findings of this research make a significant contribution to knowledge in bridging spatial data management between official spatial data and crowd-sourced geographic information in planning practice, especially as it is applied in Indonesia. SDI and VGI integration will require extensive rebuilding of spatial data streams and institutional plans. The SDI and VGI integration approaches present spatial data streams, which are genuinely two-way and include plans of action. This approach enhances transparency and ease of working in a transparent environment also an important step towards increasing democracy in spatial planning, particularly in Indonesia but also in other countries with similar levels of economic development.

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Glossary and Abbreviations

A

ACCESS	Australian Community Development and Civil Society Strenghthening Scheme project
ADB	Asian Development Bank
AIFDR	The Australia-Indonesia Facility for Disaster Reduction
AIPD	The Australia Indonesia Partnership for Decentralization
APBD	*Anggaran Pendapatan dan Belanja Daerah* (Local Budget Revenue and Expenditure is the annual financial plan of local government in Indonesia were approved by the local people's representative assembly . The budget is set by the local regulation)
APBN	*Anggaran Pendapatan dan Belanja Negara* (the Indonesian government annual financial plan)
APIs	Application Programming Interfaces
ATR	*Kementerian Agraria dan Tata Ruang* (The Ministry of Agrarian and Spatial Planning)
AusAID	Australian Agency for International Development

B

BAKORSURTANAL	*Badan Koordinasi, Survey dan Pemetaan Nasional* (Former Indonesian National Mapping Agency nomenclature)
BAPPEDA	*Badan Perencanaan dan Pembangunan Daerah* (The Local/Regional Development Planning Agency)
BAPPEKO	*Badan Perencanaan dan Pembangunan Kota* (Municipality Planning Development Board)
BAPPENAS	*Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan National* (The Ministry of National Development Planning/National Planning Development Agency)
BAPPEPROV	*Badan Perencanaan dan Pembangunan Provinsi* (The Provincial Development Planning Agency)
BIG	*Badan Informasi Geospasial* (The new Indonesian National Mapping Agency Nomenclature)
BKD	*Badan Kepegawaian Daerah* (The Regional/Local Employment Board)
BKPR	*Badan Koordinasi Penataan Ruang* (The Spatial Planning Coordinating Board)
BKPRN	*Badan Koordinasi Penataan Ruang Nasional (*The National Spatial Planning Coordinating Board)
BKPRD	*Badan Koordinasi Penataan Ruang Daerah* (The Local/Regional Spatial Planning Coordinating Board)
BNPB	*Badan Nasional Penanggulangan Bencana* (The Indonesian National Disaster Management Agency)

BPBD	*Badan Penanggulangan Bencana Daerah* (Regional Disaster Management Agency)
BPPT	*Badan Pengkajian dan penerapan Teknologi* (The Indonesian Agency for Assessment and Application of Technology)
BPK	*Badan Pemeriksa Keuangan* (The Supreme Auditing Body)
BPN	*Badan Pertanahan Nasional* (Land Administration Agecy)
BPS	*Badan Pusat Statistik* (Central Bureau of Statistics)
Bupati (Indonesian)	Head of Regency

C

3C	Collaboration, Cooperation, Coordination
Camat (Indonesian)	Head of the Sub-District
CU	Clearing Unit

D

DAAD	Deutscher Akademischer Austauschdienst (German Academic Exchange Service)
Desa (Indonesian)	Village
Desurtanal	*Dewan Survey dan Pemetaan Nasional* (National Survey and Mapping Board)
DPD	*Dewan Perwakilan Daerah* (The Indonesian Local/Regional Representative Council)
DIKW	Data, Information, Knowledge, Wisdom
DPR RI	*Dewan Perwakilan Rakyat Republik Indonesia* (the Indonesian House of Representatives)

E

E-Musrenbang	Electronic Murenbang (Public Participation through electronic applications in Personal Computer or Smartphone)
ESRI	Environmental Service Research Institute

F

FGDC	Federal Geographic Data Committee

G

GBHN	*Garis-garis Besar Haluan Negara* (The guidelines of state policy is the state policy on the administration of the state in the outlines of a declaration of will of the people as a whole and integrated.)
GeoKKP	*Geo Komputerisasi Kantor Pertanahan* (The Application activity computerization of land)
GIS	Geographical Information System
GISc	Geographical Information Science
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (a German Development Agency)

GMRIS	Geographic Management Resources Information System
GoI	Government of Indonesia
GPS	Global Positioning Systems

H

HOT	Humanitarian OpenStreetMap Team

I

IBM	International Business Machine
ICT	Information and Communication Technology
ICEL	The Indonesian Centre for Environmental Law
IGD	*Informasi Geospasial Dasar* (The Basic Geospatial Information)
IGI	The Indonesian Governance Index
IGT	*Informasi Geospasial Tematik* (The Tematic Geospatial Information)
IIG	*Infrastruktur Informasi Geospasial* (Geospatial Information Infrastructure)
InaGRES	the Indonesian Green and Resilient Cities Project Planning System
InaSAFE	free software that allows disaster managers to study realistic natural hazard impact scenarios for better planning, preparedness and response activities.
IndII	The Indonesian Infrastructure Initiative
INFID	The International NGO Forum on Indonesian Development
I-SRI	Indonesian Spatial Data Infrastructure Readiness Index
ISO	International Organisation for Standardisation
ITB	*Institut Teknologi Bandung* (Bandung Institute of Technology)

J

JPEG	Joint Photographic Expert Group
JICA	Japan International Cooperation Agency
JIGN	*Jaringan Informasi Geospasial Nasional* (Former Indonesian NSDI nomenclature)

K

Kabupaten (Indonesian)	Regency
Kecamatan (Indonesian)	District
Kelurahan (Indonesian)	Urban Sub-District
Kepala Desa (Indonesian)	Head of village
Kosurtanal	*Komando Survey dan Pemetaan Nasional* (National Survey and Mapping Command)
Kota (Indonesian)	Munipality
KSN	*Kawasan Strategis Nasional* (National Strategic Site)
KUGI	Katalog Unsur Geografis Indonesia (The Indonesian Geographic Catalogue Elements Standards)

L

LADM	Land Administration Domain Model
LAP	Land Administration Project
LAPAN	*Lembaga Antariksa dan Penerbangan Nasional* (Indonesian National Institute of Aeronautics and Space).
LAN	Local Area Network
LARASITA	*Layanan Rakyat untuk Sertifikasi Tanah* (A land mobile services programme from BPN)
LIS	Land Information System
LLN	*Lingkungan Laut Nasional* (The Indonesian National Maritime Map)
LMPDP	Land Management and Policy Development Project
LOC	Land Office Computerization
LPI	*Lingkungan Pantai Indonesia* (The Indonesian coastal environmental map)
LREP	Land Resources Evaluation and Planning
Lurah (Indonesian)	Head of urban sub-district

M

MA	*Mahkamah Agung* (The Indonesian Supreme Court)
Mbps	Megabits per second
MK	*Mahkamah Konstitusi* (The Indonesian Constitutional Court)
MoU	Memorandum of Understanding
MPR	*Majelis Permusyawaratan Rakyat* (The Indonesian People's Consultative Assembly)
MP3EI	*Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia* (The Masterplan for Acceleration and Expansion of Indonesia's Economic Development)
MREP	Marine Resources Evaluation and Planning
MUSRENBANG	*Musyawarah Perencanaan Pembangunan* (Planning Development Forum is an annual event where residents meet to discuss the issues they face and decided to short-term development priorities. When priorities are decided, they are proposed to the government at a higher level, and through the planning agency (Bappeda) public proposals are categorized according to the issues and budget allocations.)

N

NGIN	National Geospatial Information Network
NGO	Non Government Organisation
NLP	*Nomor Lembar Peta* (Sheet Map Number)
NMA	National Mapping Agency
NN	Network Node
NNC	Network Node Connector
NSDI	National Spatial Data Infrastructure

O

ODbL	Open Database License
OMP	One Map Policy
OSM	OpenStreetMap

P

PDP	*Pusat Data Provinsi* (Provincial Data Centre)
P2DTK	*Program Percepatan Pembangunan Daerah Tertinggal dan Khusus* (Accelerate Development of Disadvantaged Areas Programme)
P4T	*Penguasaan, Pemilikan, Penggunaan dan Pemanfaatan Tanah* (Inventory and Register Control, Ownership, Use and Utilization of Land)
Pancasila	Indonesian state philosophy which has meaning in every Indonesian life aspect, society and the state should be based on the value of the Divinity, Humanity, Unity, Democracy and Justice.
Perda	*Peraturan Daerah* (The Local government regulation)
Perdes	*Peraturan Desa* (The rural government regulation)
Petok	Parcel Boundaries
PERMENDAGRI	*Peraturan Menteri Dalam Negeri* (The Ministry of Home Affair Regulation)
PGIS	Participatory Geographical Information System
PKPS	Program Kerjasama Pemerintah dan Swasta (Public-Private Partnership)
PNPM	*Program Nasional Pemberdayaan Masyarakat Mandiri* (National Community Empowerment Programme)
PNG	Portable Network Graphics
PPAT	*Pejabat Pembuat Akta Tanah* (Land Deed Officer)
PPGIS	Public Participatory Geographical Information System
PPID	*Pejabat Pengelola Informasi dan Dokumentasi* (the Information Management and Documentation Officer)
PPIDS	*Pusat Pengembangan Infrastruktur Data Spasial* (the Research Center for Spatial Data Infrastructure Development)
PUSDATIN	*Pusat Data dan Informasi* (Data and Information Centre)

R

RBI	*Rupabumi Indonesia* (The Indonesian topographic map)
RDTR	*Rencana Detail Tata Ruang* (Detail Spatial Plan)
RePPPRoT	Regional Physical Planning Programme for Transmigration
RePPMiT	Regional Physical Planning for Map Improvement
RKP	*Rencana Kerja Pemerintah* (Government Working Programme is a translation of the Medium-Term Development Plan (RPJM) which includes the goals, policy direction and development strategies.)

RPJM	*Rencana Pembangunan Jangka Menengah* (The Medium-term Development Plan is a planning document for the period of 5 (five) years.
RPJMD	*Rencana Program Jangka Menengah Daerah* (Local RPJM)
RPJMN	*Rencana Program Jangka Menengah Nasional* (National RPJM)
RPJP	*Rencana Pembangunan Jangka Panjang* (The Long-term Development Plan is macro development planning document that contains the vision, mission and the direction of development period of 20 years.
RPJPD	*Rencana Program Jangka Panjang Daerah* (Local RPJP)
RPJPN	*Rencana Program Jangka Panjang Nasional* (National RPJP)
RTBL	*Rencana Tata Bangunan dan Lingkungan* (the Building Management Plan and Environmental)
RTRW	*Rencana Tata Ruang Wilayah* (Spatial Plan)
RTRW Kab.	*Rencana Tata Ruang Wilayah Kabupaten* (Regency Spatial Plan)
RTRW Kota	*Rencana Tata Ruang Wilayah Kota* (Municipality Spatial Plan)
RTRWN	*Rencana Tata Ruang Wilayah Nasional* (National Spatial Plan)
RTRWP	*Rencana Tata Ruang Wilayah Provinsi (Provincial Spatial Plan)*
RUU KMIP	*Rancangan Undang-Undang Kebebasan Memperoleh Informasi Publik* (Draft of Freedom of Infornation Act)
RZWP3K	*Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil* (the Zoning Plan for Coastal Areas and Small Islands)

S

SDI	Spatial Data Infrastructure
SHGB	*Sertifikat Hak Guna Bangunan* (Land rights certificates)
SHM	*Sertifikat Hak Milik* (Certificate of Property Rights)
sigNAS	*Sistem Informasi Geografis Nasional* (The Indonesian National Geographical Information System forum)
SIMTANAS	*Sistem Informasi Manajemen PerTAnahan NASional* (The National Land Management Information Systems)
SIMPADU	*Sistem Informasi Pengelolaan Administrasi Ketatausahaan Terpadu* (Integrated Administration Information Management System
SIPS	Surabaya Integrated Planning System
SITR	*Sistem Informasi Tata Ruang* (Spatial Planning Information System)
SKPD	*Satuan Kerja Perangkat Daerah* (local government institutions in Indonesia (either province or regency/municipality))
SOP	Standard Operating Procedure

SPPN	*Sistem Perencanaan Pembangunan Nasional* (National Development Planning System is an integral part of development planning procedures to produce long-term, medium-term and annual development plans, carried out by jointly by state and society at central and regional levels)

T

TIFF	Tagged Image File Format

U

UAV	Unmanned Aerospace Vehicle (UAV)
UGM	*Universitas Gadjah Mada* (Gadjah Mada University)
UI	*Universitas Indonesia* (University of Indonesia)
UKP4	*Unit Kerja Presiden Bidang Pengawasan dan Pengendalian* (Presidential Work Unit for Development Supervision and Control)
UN	United Nations
UNCRD	United Nations Centre for Regional Development
UPTD	*Unit Pelaksana Teknis Daerah* (the Technical Implementation Unit Regional Office)
USGS	United States of Geological Survey
UUD 1945	*Undang – Undang Dasar 1945* (The Indonesian Constitution)
UU KIP	*Undang-Undang Keterbukaan Informasi Publik* (Freedom of Information Act)

V

VGI	Volunteered Geographic Information

W

Walikota (Indonesian)	Mayor
WAN	Wide-Area Network
WWW	World Wide Web

Z

ZEE	*Zona Ekonomi Ekslusif* (The Exclusive Economic Zone)

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To **BIG**

To **HOT INDONESIA**

To **ATR**

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To **KKP**

To **BAPPENAS**

To **Government of Bojonegoro Regency**

To **Government of the Province of East Java**

To **Government of Mataram Municipality**

To **Government of the Province of West Nusa Tenggara**

To **Government of Surabaya Municipality**

CHAPTER 1

INTRODUCTION AND RATIONALE FOR THE STUDY

1.1 Introduction

The aim of this thesis is to understand the links between spatial data sharing and democractic decision-making in Indonesian spatial planning by formulating new approaches of integration of official spatial data and crowd-sourced geographic information in spatial planning process. The research focus concerns six themes; **firstly**, investigating the role of spatial data in Indonesian spatial planning; **secondly**, investigating processes that the central government of Indonesia used to develop National Spatial Data Infrastructure (NSDI); **thirdly**, exploring how citizen-made spatial data in the context of Volunteered Geographic Information (VGI) contributes to enhanced democracy in spatial planning.

Fourth, the thesis examines spatial data management performance in Indonesian spatial planning processes at national, province, regency and municipality levels; **fifth**, it examines the potential for the integration of official spatial data and citizen-made spatial data to support the formulation of spatial planning in Indonesia; and **finally**, this thesis seeks to examine how SDI and VGI integration can enhance democracy in Indonesian spatial planning.

1.2 Motivation and rationale for the study

Data has substantial value for knowledge and understanding of urban and regional phenomena. Traditionally, producing and providing data consumed energy, time and cost. The process of obtaining data then transforming it into information requires intensive surveys, long data retrieval periods, acquisition and operational costs as well as the analysis and interpretation need to turn data into information. For an extended period, the nature of data acquisition occurred in a restricted authority access only.

Today, access to official data situation has dramatically changed. Currently, intitutions and individuals can quickly and easily produce massive amounts of data. International Bussiness Machine (IBM) stated that today the world produces 2.5 quintillion bytes of data every day, and 90% of the data that exists in the world has been produced in the last two years (IBM, 2016). The phenomenon is helping change access to data from a restricted authority era into an open data era.

Governments at all levels (*i.e.* central, regional and local levels) can run their programmes drawing on accurate, seamless, reliable and up-to-date data, which can be transformed into useful information. Governments usually generate the information by compiling it from various authorised data sources to formulate policies and strategies that affect civil society. In analysis for spatial planning management, such as planning-monitoring-evaluation activities, governments need to work with different data types, including spatial data.

Since the boom in Geographical Information Systems (GIS) technology in the 1990s, governments, businesses and civil society in general have utilised spatial data to transform spatial information to support practical decision-making activities (Onsrud and Rushton, 1995). GIS now becomes a necessary method for transforming spatial data to support the spatial planning policy processes (Rajabifard *et al.*, 2003b). Most spatial data are partially provided by government agencies and partially by the private sector, but not all government and private agencies have the ability to share and exchange spatial data. Since spatial data are developed in a fragmented way, inadequate accessibility and interoperability of the data occurs (Crompvoets *et al.*, 2008).

Recently, many countries have considered tackling the fragmentation of spatial data development by reaching agreement on sharing fundamental spatial datasets to achieve spatial information integration between government institutions and private agencies at all levels in a state. This has resulted in the development of relatively new spatial data management systems, called a Spatial Data Infrastructure (SDI), which includes technology, policy, datasets criteria, standards and people in its management (Rajabifard and Williamson, 2001; USA Executive Order 12906, 1994).

In terms of the relationship between spatial data and spatial planning documents, the content of spatial planning documents predominantly provides a textual context of governmental programmes, with less spatial visualization and spatial information at all levels. Theoretically, governmental programmes should be synchronized from central government to local governments and *vice versa*. However, in fact, when particular governments have implemented their programmes in real development projects, many issues have arisen; for instance, land disputes, unbalanced financial distribution from national to local levels and inappropriate public service delivery from government to citizens. These often occur due to an inappropriate implementation of the governmental programmes local or regional geographical characteristics.

Despite the widespread acceptance of the importance of governance across official documents, spatial data and its derivatives, spatial information receives much less attention in the governance process (Vincent, 2008). This is particularly surprising in relation to the field of spatial planning, where coordinated governance across space is so centrally important, spatial information as part of spatial studies rarely examines governance processes as they apply to urban and regional planning field.

The SDI may support political communication through spatial data sharing between government agencies with involving data, people, technology, policy and organisational factors (Rajabifard and Williamson, 2001). Masser (1998b) argues that a key factor of geographic information dissemination is management undertaken by government in the spatial planning process. Thus, the relationship between SDI and political communication can be understood by exploring a governmental system.

On the other hand, more recently, crowd-sourced information is used to produce and improve collective knowledge and community capacity building. Triggered by broadening and expanding access to the Internet and cellular telephones, the utilisation of crowd-sourcing for policy advocacy, e-government and e-participation has increased globally (Shirky, 2008).

Crowd-sourced information can conceivably support government's or general social initiatives to inform, counsel, and cooperate, by engaging subjects and empowering decentralisation and democratization (Bott *et al.* 2014). Crowd-sourcing has turned into an major technique for interactive mapping initiatives by urban or rural community because of its capability to incorporate a wide range of data. Continuously accumulated spatial data can be sorted, layered, and envisioned in ways that even beginners can comprehend with ease.

In terms of solving spatial data fragmentation and lack of coordination in spatial governance issues, communication between stakeholders and spatial planning actors becomes a fundamental factor in collecting information from agencies and giving feedback from data and information users. However, research on communication relating to SDI in government level and the relationship with crowd-sourced geographic information or VGI, is still in its infancy and invites a challenge for the new knowledge. Learning from the best practices of democratic planning systems by implementing the SDI system, Indonesia as a country with a system of democratic government has initiated the use NSDI to achieve coherence and collaboration in spatial planning from the national to the local levels.

1.3 Potential contribution to knowledge

In this digital age and information era, the generation of information is leading over material creation and traditional services. An ever increasing number of circles of private life and public activity is commanded by new information correspondence. The new innovations offer complex conceivable outcomes to get to and exchange with applying the new innovation to a wide exhibit of spatial planning related applications, starting from GIS to virtual city nets. The expectation is that the new information generation will empower urban and regional planners to make a better dialogue with society (Kunzmann, 1999).

In some practices, GIS has long been operated as a vital and integral part of planning process. GIS offers many benefits for urban and regional planners, for example, recommendation related to GIS modelling and spatial analysis have been very useful for spatial planning policy-making (Ottens, 1990). However, studies on GIS modelling and spatial analysis by geography and planning scholars so far have neglected the balance between provision and sharing of spatial data or information. As the result, because of the large amount of GIS modelling and spatial analysis, particularly for developing countries, it take longer time complete spatial analysis until producing spatial policies. This is because the analysis cannot be started straight away, but should wait until the spatial database established.

There have been many studies on official spatial data provision and sharing in the context of SDI by geospatial and planning scholars (for example, Coleman and McLaughlin, 1998; Masser, 1999; Rajabifard and Williamson, 2001; Nebert, 2004). Most of these studies examined the concept and theory of NSDI in relation to non-technical GIS diffusion (i.e. policy, human resources, organisation standardisation and SDI hierarchy). A lot of research relevant to organisational management in an SDI context have been developed by several SDI scholars such as Rajabifard and Williamson (2003b), Warnest *et al.* (2003), Masser (2005), and Dessers *et al.* (2009). On the other hand, crowdsourcing geographic information in the context of VGI also have been studied by many GIS scholars from various perspectives, such as VGI theoretical and concepts (Goodchild, 2007); VGI methods (Rouse et al., 2007; Tulloch, 2007); the nature of voluntarily motivation to provide and sharing spatial data in communities (Coleman et al., 2009); and VGI spatial data accuracy (Haklay, 2010).

In order to understand the mechanism of spatial data sharing in particular groups, they focus of inquiry has been on how to make a better SDI and VGI implementation rather than to understand how SDI and VGI can be integrated in the context of national spatial data management in order to support spatial planning policies formulation. Therefore, the present study has filled in this gap and contributed to the improvement of spatial planning method to enhance spatial information by integrating SDI and VGI.

1.4 Research problem

The research problem studied in this thesis seeks to address the gap of quality, quantity, accurate and seamless provision of spatial data at different levels of government in Indonesia. This is based upon the NSDI context to support coherent and collaboration of spatial planning agenda at all levels. In addition, this research involves understanding the contribution of crowd-sourcing geographic information in a VGI context to gain local spatial knowledge and update spatial data in the earliest possible phase of the planning process. This would help planning agents and policy makers understand local geographical characteristics related to spatial planning policy formulation.

The research problem is conceptualised in relation to six key elements:

1. The lack of attention by government to spatial data and information management involved in government programmes, particularly in spatial planning activities;
2. Current lack of dissemination and interchangeability of available spatial data and information;
3. With the support of the internet, telecommunication devices and user-friendly spatial data-making applications, citizens can contribute to spatial data production with details and updated circumstances. However, the

potential of positive contributions by citizens is still neglected by government attentions;

4. There have been fragmented cross-jurisdictional processes for spatial data management and exchanging information in spatial planning programme implementation at national, province, municipality and regency levels;
5. Many Indonesian territories still not mapped by government agencies, thus, this situation is required to find alternative solution by collaborating with citizen society to participate generates spatial data;
6. Research and development activities in the field of spatial data and information sharing and exchange remain underdeveloped.

The six elements of the research problem have been identified as the basic issues for the researcher in exploring the readiness of Indonesian planning boards to adopt NSDI to support statutory spatial planning policy. According to Geudens *et al.* (2009), the lack of data-sharing leads to lower quality of spatial data, and consequently wastes resources, particularly in state expenditure. Furthermore, fragmented spatial data management between government institutions has produced spatial planning conflicts between government programmes and their real implementation in urban or rural projects.

One of the spatial planning problems and land disputes in Indonesia occurs due to the insufficient quantity and quality of spatial data (Martha, 2012), for instance, data on different land uses between two or more areas in adjacent locations. This deficit is not only about the availability of the up-to-date, accurate and reliable spatial data and information, but also the absence of national spatial data standardisation; the lack of spatial information management strategies; funding; human resource capabilities; and institutional collaboration. Even though this research explored Indonesian circumstances, these problems resonate much more widely in other less wealthy nations. Therefore, the outcomes of the study are generalizable in this respect.

Up until now, government and private sector spatial data and information infrastructure in Indonesia remains a partial activity according to the needs and policies of each sector. Furthermore, because of the factors noted above such as shortage of funds, technology and human resources, the provision of spatial data and information do not thoroughly cover the entire territory of the Republic of Indonesia (BAKORSURTANAL, 2005).

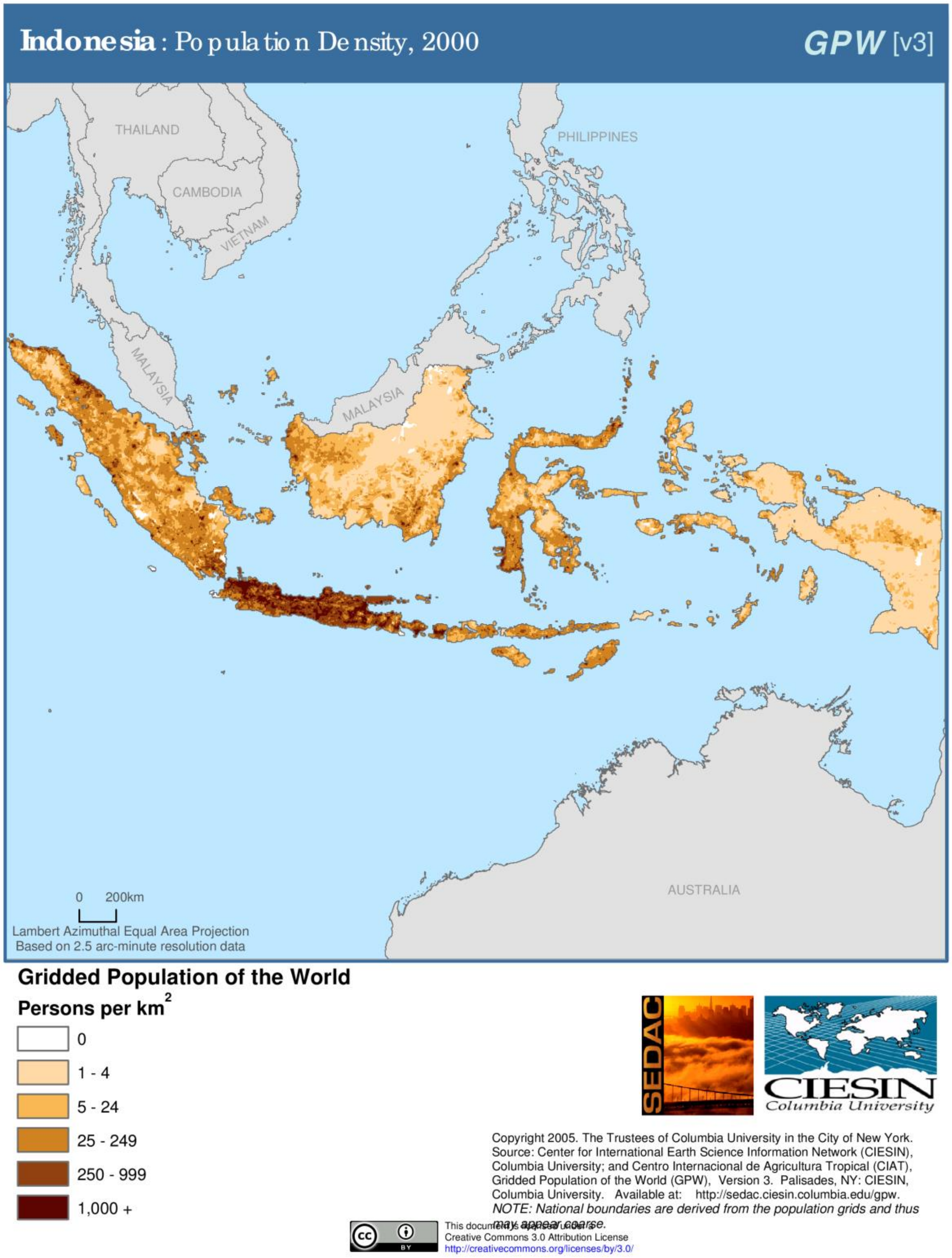
Typical issues of spatial data and information diffusion in Indonesia can be identified as follows:

1. Spatial data are available in each Ministry and state agency, but are not easily accessible.
2. Spatial data are available in each Ministry and state agency but are not integrated.
3. There is duplication of spatial data procurement amongst Indonesian Ministries and other Indonesian government agencies.
4. Spatial information providers in each Ministry or state agency develop their own base map.

(Source: Purnawan, 2010)

1.5 Research area

Indonesia is an archipelago country, which includes 17,508 islands. Located between two continents - Asia and Australia/Oceania - Indonesia's territory extends 3,977 miles between the Indian Ocean and the Pacific Ocean (see Figure 1.1) (Indonesian Ministry of Home Affairs, 2013). The population of Indonesian based on Indonesia Statistical Agency figures for 2010, was 237,641,326 people. Administratively, Indonesia has 34 provinces; 98 municipalities (*kota*); 399 regencies (*kabupaten*); 6,994 districts (*kecamatan*) and 72,944 sub-districts/villages (*kelurahan/desa*) (Indonesian Ministry of Home Affairs, 2013).



Source: http://sedac.ciesin.columbia.edu/data/set/gpw-v3-population-density/maps?facets=region%3Aasia&facets=country%3Aindonesia

Figure 1.1 Location and Population Density of Indonesia

The initial spatial planning system in Indonesia gained legal basis with the passage of The Indonesian Spatial Planning Law. No.24/1992, and amended by Law no. 26/2007. The Indonesian spatial planning system has a hierarchical structure of national, provincial and municipality/regency levels. The spatial planning system at the provincial and municipality/regency levels give guidelines for spatial structures and sustainable land use planning to achieve an efficient planning process that is appropriate to the national spatial planning vision and goals (Djunaedi, 2012).

1.6 Spatial data usage in the Indonesian spatial planning process

The initiation of spatial data usage in Indonesia started with the establishment of the Indonesian National Survey and Mapping agency in 1969 (*Badan Koordinator Survey dan Pemetaan Nasional,* BAKORSURTANAL). The scope of activites for BAKOSURTANAL in the preliminary period covered the primary survey and mapping of national natural resource inventories (BAKORSURTANAL, 2009). Between the 1970s and 1990s, BAKORSURTANAL mapping activities were conducted by an analogue method or paper-based mapping. At this time, there were only a small number of computer units available for operations and the budget for obtaining and operating computers was expensive (BAKORSURTANAL, 2009). However, spatial planning activities in Indonesia had began earlier in 1948 for the purpose of the designing and laying out colonial settlements. Spatial planning activities in this era were only focussed on eight major cities: Batavia (and certain suburbs), Surabaya, Semarang, Malang, Cilacap, Pekalongan, Padang and Palembang (Moeliono, 2011). Spatial data collection for planning purposes in this era was based on primary data collection from a survey carried out by Dutch engineers.

Between the 1950s and 1990s, the Indonesian spatial planning process continued to expand the city master planning formulation in particular major cities. In the same period, another Indonesian government effort was directed to preparing the administrative control of planning, the establishment of national and regional planning agencies and the enactment of laws and regulations related to spatial planning. The use of spatial data in Indonesian spatial planning began in the 1990s concurrently with the passage of the spatial planning Law No. 24/1992. Today, enhanced spatial data usage in Indonesian spatial planning processes is strongly supported by the amendment to the Indonesian spatial planning law in Law No.26/2007, and in the Government of Indonesia (GoI) Regulation No.8 of 2013 relating to accuracy in the spatial plan map.

1.7 Background to the Indonesian NSDI initiative

The impact of GIS on spatial analysis purposes in developing countries began in 1988 when the United Nations Centre for Regional Development (UNCRD) launched a series of adoption and diffusion of information systems in urban, regional and development planning agencies studies in developing countries, include Indonesia (Batty, 1992; Klosterman, 1995). This event conducted by giving training and workshops from UN experts to government agencies to improve capacity building in spatial planning practices by adopting GIS in supporting spatial planning policies formulation. This event had implications for Indonesia, which was still included in the developing country category, but was rapidly embracing geospatial information technology very quickly.

At the completion of the UNCRD programme in the early 1990s, GIS technology has spread even more generally in Indonesia. Cheaper GIS software and hardware have supported widespread GIS activities for various purposes. However, this also led to spatial data duplication and less reliable spatial data that discouraged national spatial data management. In terms of spatial information management solutions, the Indonesian government considered applying the effective and efficient spatial data and information procedures for spatial planning by implementing *Infrastruktur Data Spasial Nasional* (IDSN) or NSDI mechanism. However, in 2016 the Indonesian government is still developing the appropriate spatial data management approaches and models to facilitate the NSDI implementation.

Indonesia initiated the earliest NSDI initiative in Asia, at the beginning of 1991, through the establishment of the *Forum SigNAS* (National Geographical Information System Forum). The SigNAS Forum initiated by BAKORSURTANAl, which at the time had role of tackling difficulties in obtaining spatial data, creating spatial data standardisation and avoiding duplication spatial data provision projects by government institutions (Lilywati and Gunarso, 2000). However, due to lack of coordination and lack of legal ability to enforce its programme, the SigNAS Forum did come into effective existence for almost a decade. In 2000, the desire to manage national spatial data was resurgent. At that time, Indonesian national surveying and mapping coordination workshops had been organised by the BAKORSURTANAL. The workshops gave a critical result of the vision “To realize the reliable NSDI in Indonesia” (Matindas, 2003).

1.8 Background to the Indonesian VGI initiative

Spatial data creation based on voluntary activity in Indonesia has been implemented since the 2000s. One of the initial VGI activities in Indonesia was a green map programme. The Green Map programme consisted of maps generated by local communities of the potential of natural and cultural resources in community living places. The Green Map charted all places and phenomena, whether positive or negative and aimed to help people see, judge, connect, and care about the environment where they are located.

There are all sorts of different platforms and bases for these kinds of ‘grass roots’ community mapping initiatives but VGI in Indonesia uses Openstreetmap (OSM). OSM was introduced into Indonesia at the request of the government in 2011 by the Humanitarian Openstreetmap (HOT) organisation. The Indonesian National Disaster Management Agency (BNPB) needed spatial data and information for use, before, during and after a disaster events, including spatial information visualization at detailed map scale of 1:500, 1:1000; 1:5000. However, *Badan Informasi Geospasial* (BIG), current Indonesian Mapping Agency, the Indonesian official government institution creating and providing spatial data, could not produce the data in the detail and at the scale required by BNPB, due to lack of capabilities regarding human resources, technology and financial support in mapping detail scale geographic information. Lacking existing spatial data and information regarding human activities and places, the Government of Indonesia approached HOT with a request to utilise the OSM innovation as part of the VGI activity to collect disaster readiness information.

1.9 The Indonesian ‘One Map Policy’ context

This study emerged from a policy focus on national spatial data sharing to achieve the integration spatial planning programmes at all levels that stresses the concept of the One Map Policy (OMP). The idea behind OMP is to have a single 'map' or spatial infrastructure which serves the entire nation. This map should be able to be deployed at different scales and for different purposes but also allow all users a single point of spatial reference that is consistent, rigorous and robust. Furthermore, the idea of OMP not only considers technical aspects of spatial data infrastructure, but also non-technical GIS matters, such as strategic management, human resource capacity and institutional collaboration. (The details of Indonesian OMP will be examined in Chapter 6 Section 6.5).

1.10 Research Aim

This research aim to understand the links between spatial data sharing and democractic decision-making in Indonesian spatial planning by formulating new approaches of integration of official spatial data and crowd-sourced geographic information in spatial planning process. It highlights the processes and decisions made by the Indonesian government in order to operate the NSDI and it investigates the potential for integration with VGI in civil society in support of the spatial planning process.

1.11 Research Objectives

In order to achieve the aim, the objectives of this study are to:

- Investigate the role of spatial data in the Indonesian spatial planning process;
- Investigate the Indonesian central government efforts to achieve spatial data standardisation, strategic management, human resource capacity and organisational structures to be involved in NSDI operations;
- Examine the role of spatial data created by citizens;
- Investigate the readiness of province and local (municipality and regency) planning boards to adopt the NSDI system;
- Examine potential integration of SDI and VGI; and
- Suggest a potential SDI and VGI integration approach for enhancing democracy in spatial planning.

1.12 Research approach

The research in this study has been conducted predominantly through the approach of grounded theory. The reason for selecting this methodology was to enable an in-depth understanding of the potential of NSDI and VGI integration in Indonesian spatial planning formulation at all levels. (The details of the research approach are discussed in Chapter 4).

In supporting a spatial data sharing study, this thesis draws on open data, organisational behaviour and community empowerment rationales through ICT to develop new concepts, approaches and models for the integration of the official spatial data provided by government with spatial data that produced by VGI to support spatial planning formulation at all levels.

1.13 Research questions

The general problem researched in this study is how spatial data sharing can enhance democracy in the Indonesian spatial planning process. The specific research questions are as follows:

1. Why do spatial data and information have a significant role in Indonesian spatial planning process?
2. What processes has the central government of Indonesia used to develop NSDI?
3. How is spatial data created by citizens used in Indonesia?"
4. How is spatial data management performing at the provincial and local government levels in supporting Indonesian NSDI?
5. How can SDI and VGI be integrated to meet top-down and bottom-up developmental approaches?
6. How can SDI and VGI integration enhance democracy in spatial planning?

1.14 Structure of the thesis

After the background given in this introduction, **Chapter 2** examines a range of literature from relevant academic fields to assist in building a fundamental understanding of the research field. The literature review starts by investigating rationales for the need for spatial planning and spatial data sharing. Then, the discussion continuea by examining the philosophy of data and open data with specific exploration of understandings of the hierarchy of Data-Information-Knowledge-Wisdom (DIKW), information infrastructure, SDI and VGI theories.

In **Chapter 3**, the thesis conceptualizes the research framework by presenting the philosophical approach in examining spatial data development and sharing. The next section investigates the Coordination-Collaboration-Cooperation (3C) concept in the context of spatial governance context. The final section discusses the conceptual framework of potential NSDI and VGI collaboration in relation to integrating different levels of the spatial planning programmes.

Chapter 4 discusses the research methodology and methods. This part describes the methodological approach to collecting data, how the data was analysed and potential contributions to knowledge.

Chapter 5 attempts to examines the context of the Indonesian system of government, spatial policy and public participation characteristics. This chapter is used to understand the performance and procedures of government agencies in carrying out the planning and development, as well as getting to know the characteristics of the community in participating in the planning and development agenda formulated by the Indonesian government.

Chapter 6 focuses on discussing open data and examining GIS practices and issues in the Indonesian governmental system, as well as spatial data sharing in Indonesian Ministries and government agencies for spatial planning purposes. Finally this chapter explores the Indonesian OMP and NSDI. The chapter aims to provide a clear understanding of the relationship between open data, spatial data and information sharing in Indonesian spatial planning processes.

Chapter 7 explores the historical background of civil society participation in spatial data production to the generation of local spatial knowledge as part of planning process from participatory mapping to VGI in the current era.

Chapter 8 discusses empirical case studies of the spatial planning formulation process and GIS capacity management in the systematic hierarchical government administrative levels in *more developed regions* in Indonesia. Case study areas are the Province of East Java, Surabaya Municipality and Bojonegoro Regency.

Chapter 9 examines empirical case studies of the spatial planning formulation process and GIS capacity management in the systematic hierarchical government administrative levels *less developed regions* in Indonesia. Case study areas are the Province of West Nusa Tenggara, Mataram Municipality and Lombok Barat Regency.

In **Chapter 10**, the thesis discusses possible new concepts, approaches and models of integration of official spatial data with crowd-sourced spatial data through the SDI and VGI context.

In conclusion, **Chapter 11** examines the lessons to be learnt by investigating key findings from the empirical studies and reflecting on theoretical issues, ending with suggestions for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The opening chapter has outlined the research context of spatial data sharing and exchange in the Indonesian spatial planning. This chapter presents a review of various ways of spatial data sharing discussed in existing academic literatures. It touches upon the conceptualisation of spatial data (or information) as a geographic visual communication in the spatial planning process, and of the settings in which data is shared between government agencies and civil society.

In a grounded theory approach to research, there is a continuous open deliberation about when to carry out the literature review in the research process. Strauss and Corbin (1990) suggest that an exploratory study of literature and theories are required to contribute to the argument of the research and to avoid theoretical and methodological pitfalls. Therefore, the purpose of this reviews is to explore significant approaches to the topic and introduce a theoretical point of view to examine spatial data sharing in the spatial planning process.

This chapter will examines theories and concepts related to the main research topic in five main sections: the rationales for spatial planning and spatial data sharing; frameworks of data-information-knowledge-wisdom and the open data concept; the underlying concept of Spatial Data Infrastructure; theorise of citizen participation and citizen science; and the concept of VGI. The relationship between these factors will be examined in the contexts of policy formulation, organisation, technology and human resource factors, which are part of any spatial planning framework.

2.2 The rationale for spatial planning and spatial data sharing

Physical space can be seen as being where social systems interact, involving humans with social, economic and environmental aspects (Hall, 2002). These interaction do not always take place in balanced ways that automatically and mutually benefit all parties, because of different capabilities, interests and the cumulative nature of survival in the geospatial world. Hence, space needs to be organised so as to maintain ecological balance and provide support for human and other living organisms in producing and maintaining optimal living conditions (McLoughlin, 1969; Chadwick, 1978; Meadowcroft, 1999).

Spaces for human living as a dynamic circumstances, needs to be planned in ways that not only reflects the quality and coherence of tiered planning programmes (from national to local planning levels), but also reflect the quality of spatial planning components. That is, the qualities of the space itself are determined by the realisation of the harmony and balance of the space utilisation in relation to economic, social and environmental carrying capacity factors (Faludi, 2000).

Spatial planning should be based on understanding of the potentials and limitations of the natural environement and the socio-economic development activities in particular areas, as well as the current demands and the preservation of the environment in the future (Hall, 2002). Thus, ideally, available built space and environmental conservation need to be set out in an entire spatial planning system at all government levels in the context of spatial information/spatial visualization planning from national to local government levels and *vice versa*.

In spatial planning processes, the different aspects of human interactions involving political circumstances, social, economics, historical and cultural objectives can be understood through maps or spatial visualisations, because those media can illustrate abstract phenomena into visual images (Dühr, 2007; Stephenson, 2010). Furthermore, the spatial visualisation can assist in mediating planning debates (Healey, 1997), setting planning agendas (Forester, 1982) and incorporating various viewpoints of planning stakeholders (Robbins, 1997).

Spatial data has a role to play in spatial governance by providing thematic spatial information and analysis at all authority scales (Vincent, 2008). Furthermore, spatial data and information are prerequisites for any participation in planning deliberation helping to create consensus (Campbell and Masser, 1995). Spatial data and information currently have a role in communicating with all stakeholders (i.e. local authorities, private sectors and communities) whose interests are in development proposals in particular areas in order to decide implementation, priorities in local geographical areas (Dühr, 2007).

As Vincent (2008) elucidates, spatial information is involved in spatial governance in two ways:

1. Spatial data and Information can inform the public who have interests in planning projects by presenting projects in 3D virtual formats as a useful resource in making informed decisions.

2. Spatial data and information can explain spatial development issues all stakeholders, and help them to be aware of more or less long term spatial consequences in the future from their consensus made in the present.

In addition, Haque (2001) argues that spatial data and information have significant implications for governance processes in three ways:

1. Spatial data and information provide solid information to resolve land disputes that have consequences for the tax revenues of local governments.

2. Spatial data and information can present socio-economic population characteristics on the maps that provide pictures of local government conditions for proposing developmental budgets to central government.

3. By presenting accurate and reliable socio-economic territorial data and analysis in maps and diagrams, produced from GIS application, the decision-maker can take a critical decision to enact planning policy and regulations.

As an essential planning element, spatial visualisation and spatial information can help to achieve spatial planning consensus by shaping attention to relevant spatial issues, communicating strategic planning messages and stimulating planning actions at different government levels or within the private sectors or amongst communities (Dühr, 2007). Spatial visualisation has a significant role in integrating different governmental viewpoints for achieving planning goals from national to local levels. Several governments throughout the world are starting to consider the geographic information management by implementing Spatial Data Inftastructure (SDI) (Masser, 1998b). In spatial planning and governance processes, SDI can become part of an open governance system. Hence, in exploring SDI, this thesis will examines ideas of open data in spatial planning and governance.

In addition, crowd-sourced information- Volunteered Geographic Information (VGI)- is affecting the spatial data and information field by informing communities about their local areas. In terms of the urban and regional planning field, VGI could provide support early in the spatial planning process by adding to the existing territorial information.

Hence, topics covered in this discussion of VGI cover the characteristics of VGI, the quality of the VGI product, and the value of VGI, including how relevant communities can be formed and participatory citizen engagement in spatial planning be encouraged.

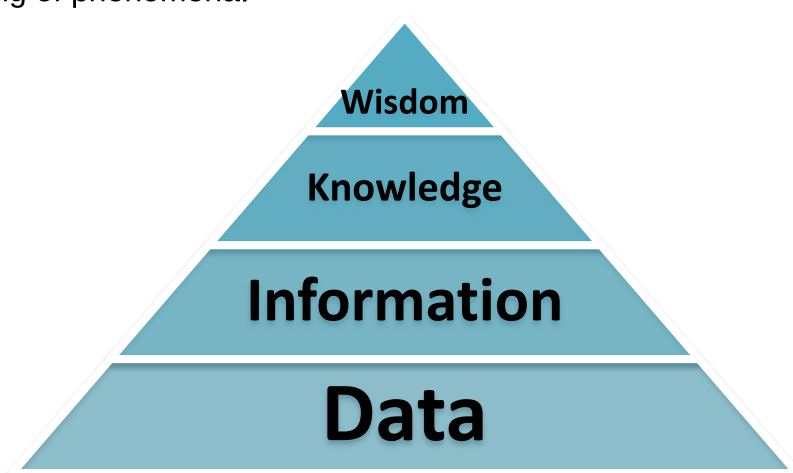
To understand how spatial planning and spatial data sharing works optimally, further sections will examine data-information-knowledge-wisdom frameworks and open data.

2.3 Frameworks of data-information-knowledge-wisdom and the open data concept

2.3.1 The framework of data, information, knowledge and wisdom

As part of the information systems discipline, the practice of GIS cannot be conducted without data, information, knowledge and wisdom (DIKW). Theoretically, the DIKW hierarchy builds as discussion on the nature of information and knowledge (Rowley, 2007). In addition, Rowley (2007: 165) argued since DIKW has become a fundamental pillar of the nature of information and knowledge, it has led to the development of disciplines, such as communication theory, library and information science, cognitive science and organisation science.

According to Ackoff (1989), 'data' can be defined as symbols to represent properties of objects obtained from observation, located at the base of the DIKW hierarchy pyramid (See Figure 2.1). 'Information' is the answer to and representations of what, why, where, when, who and how questions raised by the data and is found at the second level of the pyramid. 'Knowledge' is found at the third level of the pyramid and can be defined as a function of transforming information into instructions. Finally, 'wisdom' is at the top of the pyramid, and can be defined as the values (e.g. moral and ethical codes) necessary for evaluating the understanding of phenomena.

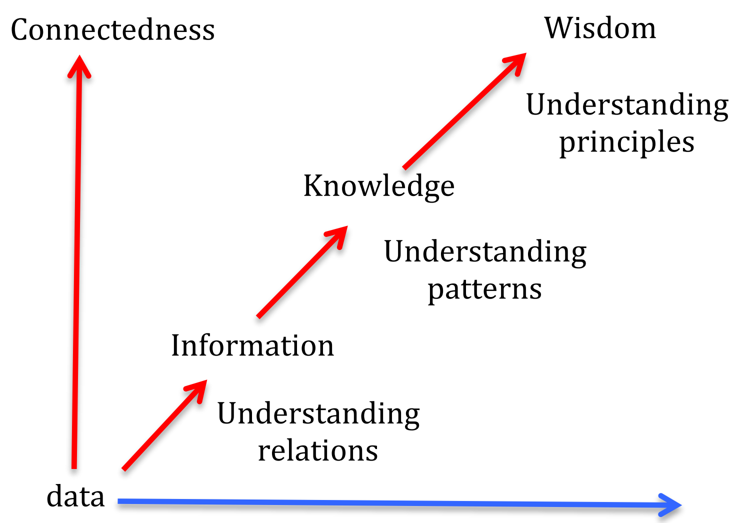


(Source: Hey, 2004, pp.3)

Figure 2.1 The Pyramid of Data, Information, Knowledge and Wisdom Hierarchy

Practically, although the term 'understanding' is not included in the pyramid, many scholars (Hey, 2004; Rowley, 2007; Schumaker, 2011) give 'understanding' a separate level. However, Bellinger *et al.*(2004) argue that the 'understanding' as a part of the DIKW hierarchical pyramid has the role of driving lower levels to upper levels. That is, 'understanding relations' will drive data into information;

‘understanding patterns’ will drive information into knowledge; and ‘understanding principles’ will drive knowledge into wisdom (See Figure 2.2).



(Source: Bellinger *et al.*, 2004 in http://www.systems-thinking.org/dikw/dikw.htm)

Figure 2.2 The Pyramid of Data, Information, Knowledge and Wisdom Hierarchicy with Understanding Term

The DIKW framework can be applied in many daily human contexts, including GIS contexts. From the raw or combined data, a geographer or planner can characterize rates of flow for a particular period of spatial phenomena, which can be called "event information". For instance, a rural planner may ascertain the rate of flow for some timeframe to figure out whether there is a change identified in an external variable, for example, water uses for agricultural purpose. A rural planner likewise may endeavor to distinguish designs in a rate of flow, for example, seasonal variations. It can be called "actionable information" (Austin, 2015: 20).

“Event information” and “actionable information” might be investigated in a few ways. Investigation of examples in relation to spatial factors could, result in what is termed "geospatial knowledge." A case of such information might be the generation of a Digital Elevation Model (DEM) concentrated on watersheds. Investigation of examples through time could result in "geospatial experience." A case of such experience may be the creation of digital surge protection rate maps (Austin, 2015: 20).

Ultimately, the merging of knowledge and experience can result in “geospatial wisdom”. For instance, by combining significant “geospatial knowledge” and “geospatial experience”, the person working with data can build a comprehension of the outcomes of changes in a stream to manage the human utilisation of the land. This understanding may empower an organiser to focus on a suitable strategy to anticipate or possibly moderate the effect (Austin, 2015: 20).

2.3.2 The concept of information as infrastructure

Since the internet achieved a critical mass in 1990s, large-scale data and information dissemination has become a major part of internet activities. Under these circumstance, the establishment of information infrastructures has been promoted by political actors to manage data traffic transaction in the virtual world. McGarty (1991: 13) defines information infrastructure as a resource with *shareable, common, enabling, enduring, resource, that has scale in its design, and is sustainable by an existing market, and is the physical embodiment of and underlying architecture*. In addition, Hanseth and Monteiro (1998: 41-44) introduce five aspects of information as an infrastructure:

- *Aspect 1: Infrastructures have a supporting or enabling function.*
  Infrastructure is designed to support broader activities in various sectors. In terms of SDI, one geodatabase portal can be used for transportation, public works, economics, agriculture, mining sector and others.

- *Aspect 2: An infrastructure is shared by a larger community (or collection of users and user groups).*
  Infrastructure is designed as media for data sharing and information amongst institutions or personal to achieve efficient work.

- *Aspect 3: Infrastructures are open*

  Open has meaning as borderless to obtain data and information, also limitless for number of users to use the application for their daily working activities.

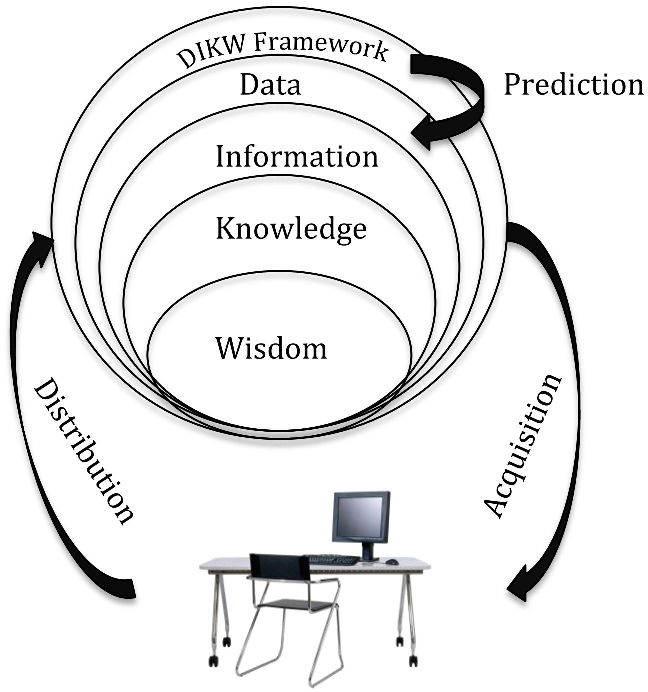
- *Aspect 4: Information infrastructures are more than "pure" technology; rather, it is socio-technical networks.*

  Information infrastructure is designed not only for underpinning the technical factors, but involves other non-technical aspects incorporating people, organisation and policy.

- *Aspect 5: Infrastructures are connected and interrelated, constituting ecologies of networks.*

  Information infrastructures provides the data or information that can be linked and integrated with cross-jurisdictional organisations creating less convoluted bureaucracy systems.

The relationship between the DIKW framework and concepts of information infrastructure concept can be adopted from Schumaker (2011). Data, information, knowledge and wisdom can be disseminated through information infrastructure by three methods: acquisition, distribution and prediction. **Acquisition** is the process of obtaining objects from web sources; **distribution** is the process of returning objects to web users; and **predictions** is the process of projecting the trends indicated by existing content (Schumaker, 2011). An illustration of the relation between the DIKW framework and information infrastructure concept can be seen in Figure 2.3



(Source: Schumaker, 2011, pp.8 with modification)

Figure 2.3 Acquisition, Distribution and Prediction in DIKW Framework

Information infrastructure in spatial data sharing is relevant to information interactions amongst GIS providers and users. In transforming spatial interaction data into spatial interaction information, Rae (2009) argues that there are four areas that require attention to achieve spatial data development and sharing. Firstly, the ability of the wider GIS user community to get access to a dynamic spatial interaction information. Secondly, spatial interaction data representation should be easily available on the web. Thirdly, the representation of spatial data in geographic and planning domains be simple and reliable. Finally, the person in charge should be capable of producing, interpreting and distributing user-friendly spatial interaction data representations.

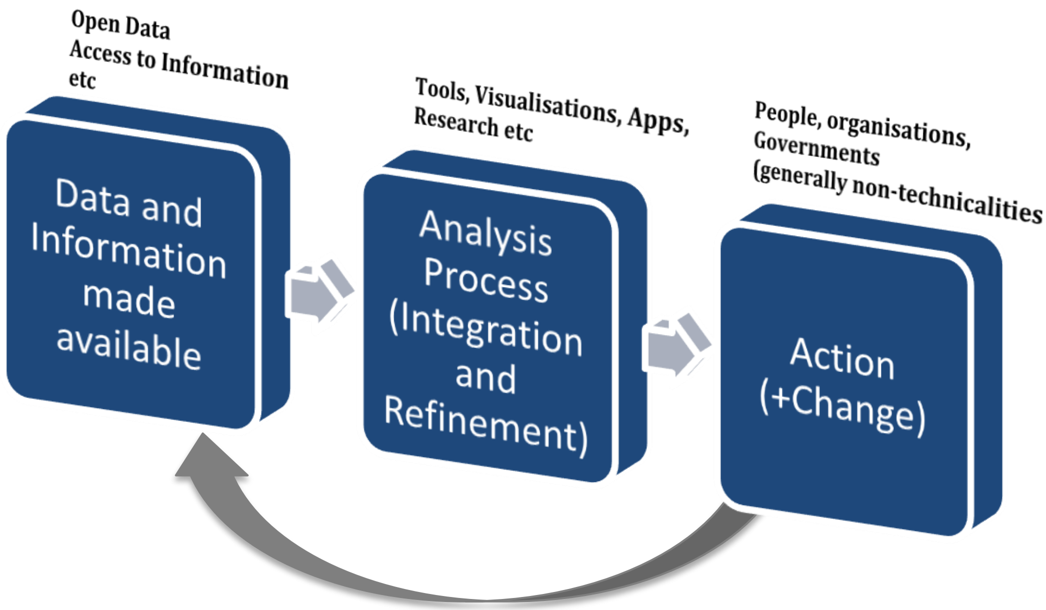
2.3.3 The underlying concept of open data

The previous section has already mentioned that one of the important aspects of information infrastructure is openness (See Aspect 3 of Hanset and Monteneiro's information infrastructure aspects). This section discusses open data in the context of the general idea of openness in the digital age. As noted in Chapter 1, in the past, producing and providing data consumed energy and time also was expensive. The process of obtaining data and then transforming it into information requires energy intensive surveys, long data retrieval periods, costs of acquisition, analysis and interpretation. So it is not obvious, for an extended period, the nature of getting data occured in a restricted particular authority access only.

Consequently, access to data or information has generally been constrained in many ways, such as users are prevented from getting access, charges for services and data usage limits through licencing or policy. Even when data or information have been open or available to use, data cannot be used directly if it is not compatible with users' devices, and users have needed specific hardware and software to process data to produce information for their particular aims.

The nature of data and information access from restricted authority access to the open for public was common until the beginning of the internet. In relation to planning processes, the introduction of access to data via the internet has been affected by the slow development of innovation, policy decision-making, and lack of democratic participation. But, since the sustainability development agenda was declared in 1992, all United Nation (UN) members have been concerned to shift their governance paradigm from *Top-Down* approach to be *Bottom-Up* to pay attention about citizen's demands to achive quality of life of their living environment (UNEP, 1992; Fukuda-Parr & Panzio, 2002). The move towards bottom-up governance has included open data policies (Huijboom and Broke, 2011).

Principally, the open data concept relates to access, use, reuse and sharing of data by the public (ODI, 2015), and especially, addresses data provided by government agencies (Kitchin, 2014). In addition, data in this context consists of all types of data, namely text, numbers, statistics, images and spatial representations. Few theories examining open data, have provided much insight, but Pullock (2012) argues that in examining an open data paradigm, it can be described as a general chain of logic (See Figure 2.4).



(Source: Pullock 2012 with modification in http://blog.okfn.org/2012/09/13/managing-expectations-ii-open-data-technology-and-government-2-0/)

Figure 2.4 The Theory of Change of Open Data

Figure 2.4 explains that in the open data paradigm, open data licensing/policies and technological interoperability dramatically increase the extent to which information can lead to action and change. These features affect, the availability of, and access to, data or information. Also affect reuse, processing and integration with other data. Where access is open, crowd-sourcing information can be created to enrich raw data to provide more useful thematic information in several sectors, such as housing, economic development, and urban infrastructure information. The associated changes in the social realm can therefore enhance the level of democracy by encouraging collaborative behaviour by engaging governments, citizens and business interests in finding solutions to social problems.

Other benefits of open data include:

1. Creating efficient working in government to deliver public services.
2. Boosting national or regional economic growth rates and leading innovation by revealing opportunities for building business enterprises
3. Keeping track of government and community spending and performance in implementation of planning and development agendas.

(ODI, 2015 in http://theodi.org/what-is-open-data)

In analysing drivers of and barriers to open data implementation, Huijboom and Broke (2011) have conducted research in five countries. According to their study, there were 10 main issues affecting motivation for and impediments to open data implementation (See Table 2.1)

Table 2.1 The Drivers and Barriers of Open Data Implementation

	Drivers of open data implementation	***Barriers to open data implementation***
1	*Strategies and experiences in front- runner countries*	*Closed government culture*
2	*Political leadership*	*Privacy legislation*
3	*Regional initiatives*	*Limited quality of data*
4	*Citizen initiatives*	*Limited user-friendliness/info overload*
5	*Market initiatives*	*Lack of standardisation of open data*
6	*Emerging technologies*	*Security threats*
7	*State legislation*	*Existing charging models*
8	*Thought leaders*	*Uncertain economic impact*
9	*Possibility of monitoring government*	*Digital divide*
10	*Budget cuts*	*Network overload*

Source: Huijboom and Broke (2011: 7 - 8)

The open data concept applied to data-sharing amongst government institutions, raises a question about why an institution should be engaged in the data and information sharing system with other institutions. In reviewing the perspective of inter-organisations cooperation in the data and information sharing context, it is useful to examine Oliver's (1990) paper which reviewed more than 160 papers considered inter-organisational relationships between 1960 to 1990. She suggests six determinants affecting inter-organisational relationships: namely necessity, asymmetry, reciprocity, efficiency, stability and legitimacy (detailed factors can be seen in table 2.2).

Table 2.2 The Essential Inter-Organisational Relationship Factors

Factors	***Definition***
Necessity	*An organisation exchanges with other organisations in order to meet necessary legal or regulatory requirements. For example, loss of resources will determine that mandated relations occur.*
Asymmetry	*Exchange relationships are established in response to power or control of another organisation. The reluctance to loss of autonomy and the desire for control reflect asymmetrical motives to interact.*
Reciprocity	*Motives of reciprocity emphasize cooperation among organisations to pursue commonly beneficial goals.*
Efficiency	*Formation of cooperation is prompted to improve the internal input/output ratio of an organisation and internal efficiency.*
Stability	*Formation of data sharing relations is an adaptive response to environmental uncertainty (generated by resource scarcity or lack of perfect knowledge) in order to achieve stability.*

Legitimacy	*Data sharing is established to appear in agreement with the prevailing norms, rules or expectations of external constituents and/or to improve the image, reputation, and prestige.*

Source: Oliver (1990: 243-246)

Oliver's (1990) work is particularly helpful to this research for suggesting reasons that drive open data or data sharing: in particular, her six determinants are applicable to spatial data infrastructure. Inter-organisational relationship factors can be described as rationale relevant to willingness to share organisational data. The next factor is asymmetry, which correlates with power as coercion to force open organisation data-sharing. Stability is associated with the prolongation of power and legitimacy rationales and considers the leverage of power in broader societal values/norms. Additionally, financial and authority aspects correlate with asymmetry, reciprocity, stability and legitimacy rationale in terms of data sharing operationalisation.

2.4 Underlying concepts of spatial data infrastructure

The three preceding sections have discussed rationales for spatial planning, the DIKW framework, information infrastructure and open data. But so far, there has not been consideration of what spatial data/information sharing practice is. Therefore, this section brings the discussion of understanding spatial data/information sharing practice to the spatial data infrastructure (SDI) context.

This section starts by presenting the fundamentals of the SDI definition in order to understand the SDI system. The next section will explores the components of different SDI models. Finally, the discussion of the SDI concept will expand to consider the relationship with organisations as a key role in achieving the successful process of spatial data transaction and sharing.

2.4.1 Why and What is SDI ?

Since geospatial data have developed in a fragmented way, inadequate accessibility and interoperability of the data have occured. As Crompvoets *et al.* (2008) argue the fragmented development of spatial data has created many including technical problems (i.e. different georeferenced systems, softwares and database utility) and non-technical problems (i.e. economic, organisational, legal and community elements) that inhibit integrating, exchanging and utilising spatial data from different sources. Therefore, recently, many countries have considered tackling fragmented spatial data development by reaching agreements for sharing fundamental geospatial datasets to achieve the geospatial information integration between government institutions and private agencies at the all levels. This phenomenon has created the concept of SDI.

Several definitions of SDI have been elucidated by various scholars for understanding its mechanism.

- The Federal Geographic Data Committee (FGDC) defines National SDI as *"as the technologies, policies, and people necessary to promote sharing of geospatial data throughout all levels of government, the private and non-profit sectors, and the academic community."*

  (FGDC, 2014 in https://www.fgdc.gov/nsdi/nsdi.html)

- Nebert (2004: 8) suggests the term SDI is *"often used to denote the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data. The SDI provides a basis for spatial data discovery, evaluation, and application for users and providers within all levels of government, the commercial sector, the non-profit sector, academia and by citizens in general."*

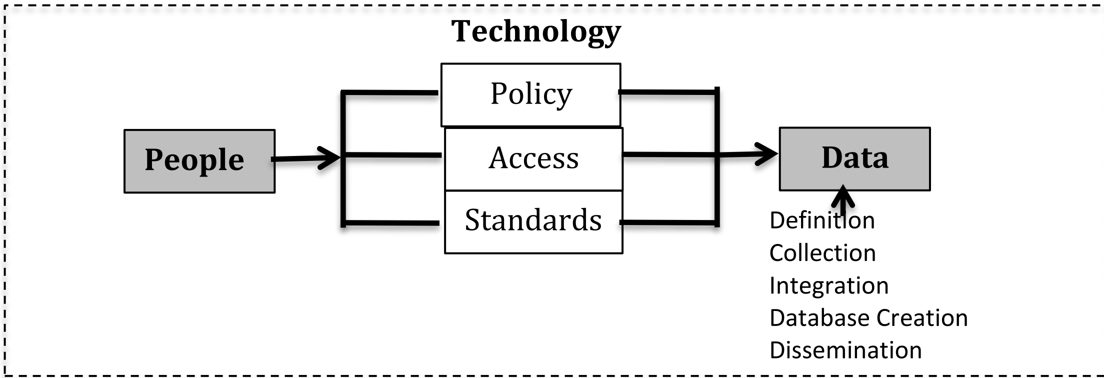
- Rajabifard (2008: 12) define SDI as

  “a dynamic, hierarchic and multi-disciplinary concept that includes people, data, access networks, institutional policy, technical standards and human resource dimensions.”

Essentially, SDI is intended to involve all stakeholders who contribute to spatial data activities at different jurisdictional levels, not only to collaborate by sharing and exchanging data to reduce duplication and save costs, but also to use the technology to achieve consensus amongst multi-level government agencies and other stakeholders (i.e. private sectors and local communities) who have interests in particular development areas.

2.4.2 SDI models and components

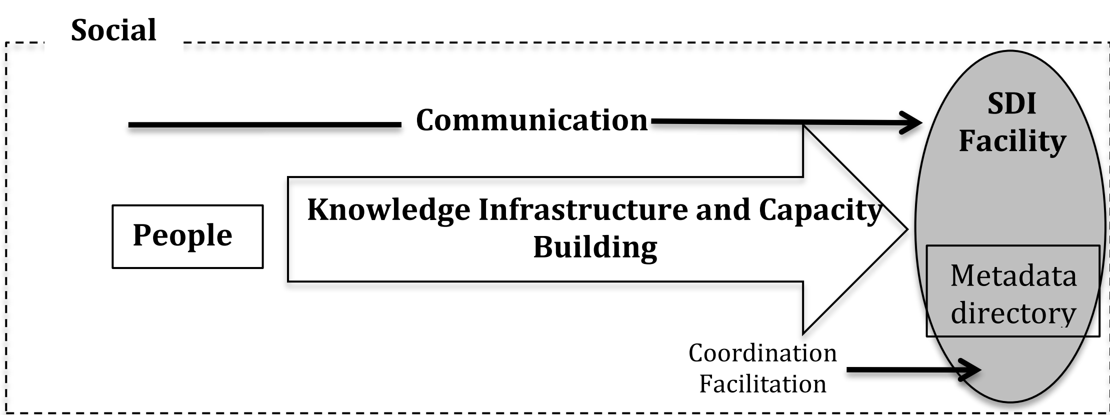
It is important to understand the components that make up spatial data infrastructure. This section begins by describing two approaches common of SDI mechanisms which are constructed from a series of SDI components. The typical SDI approaches are the Product-based Model and the Process-based Model (Rajabifard, 2001; Rajabifard and Williamson, 2001). The first model sees SDI as a facility which coordinates a geospatial database, linking people to data as the primary object with respect to the political and administrative levels (Rajabifard and Williamson, 2001) (see Figure 2.5). The model consists of three main SDI components: People, Technology and Data. The technology is built around Policy, Access and Standardisation elements. Relevant to Pullock’s (2012) theory of open data change (See Figure 2.4), Rajabifard’s model has similar pattern: the provision of data; analysis processes which involve technology and access; and people taking action for change. The difference in between these models is in the idea of data as product or part of further process. In Pullock’s model, data become recycled as part of ongoing processes, but in Rajabifard’s first SDI model, data are the product.



(Source: Rajabifard and Williamson, 2001, pp.7)

Figure 2.5 The Product-based model

An alternative model puts more emphasis on the DIKW hierarchy in the SDI mechanisms, involving many steps: awareness, knowledge infrastructure, alignment, persuasion, decisions, participation and utilisation (Rajabifard and Williamson, 2001) (see Figure 2.6).



(Source: Rajabifard and Williamson, 2001, pp.7)

Figure 2.6 The Process-based model

Five significant components can be derived from these different definitions of SDI: **data**, **people**, **technology**, **policy and regulation**, and **organisation**. Relevant to this study, all factors affect the government organisational management and performance assessment to determine role of the government to develop a NSDI capacity and the readiness regional/local planning boards to adopt the system in the planning process. These components are primary aspects of answering the research questions.

a. Data

Spatial data are primary components in all SDI models. The essential elements are comprised of standardized data and metadata. Spatial data standardisation has meant a national consensus of particular country on the user-friendly system to facilitate spatial data accessibility, exchange, sharing and integration by custodians (Msasa, 2013). The standardisation aims to produce uniform spatial data, from different institutions, sources and accuracies to synchronize in one national spatial data criteria on the principle of “one size fits all” (Masser, 2005).

Spatial metadata means that spatial data includes necessary information about the dataset creation. The appropriate spatial data management for sharing and exchanging amongst government institutions and other spatial data providers can be achieved through accountability in metadata, such as time, geospatial references and the institutions that make spatial data information (Olfat *et al.*, 2013). Furthermore, spatial data dissemination for the public domain needs to be in a user-friendly standard format to make interoperability between different devices, so that data access is available to broad range of users.

b. People

Various stakeholders across jurisdictions and institutions are involved in SDI, including geospatial data providers, users, and a relevant politicians (Rajabifard, 2001). Thus, identifying stakeholders who participate in sharing and exchanging spatial data activity circle is a crucial matter (Nebert, 2004). One management type that is required in the SDI model is the ‘custodianship’.

A custodian is a group of institutions responsible for spatial data and information validitation separate from the owner of the data. The custodian’s duties cover spatial data administration, management, distribution, procurement and update. Spatial data management should be based on standards agreed amongst the stakeholders who organise spatial data procurements (Thompson *et al.*, 2003 in Williamson *et al.*, 2003; Nebert, 2004).

c. Technology

In the SDI context, technology is important as a clearinghouse. A clearinghouse can be defined as a distributed server system on the Internet and contains a description of the digital spatial data available. This descriptive information, metadata, is provided to facilitate inquiries and specifies the presentation through multiple participating sites (Nebert, 2004). The clearinghouse can be represented as a shopping centre for spatial data transactions (Crompvoets and Bregt, 2003). In the clearinghouse, the standard spatial data and metadata of the public domain are already involved in the system. Relevant to this study, the technological component is the significant accessibility media and reveals how spatial data can be disseminated and exchanged between government institutions and other spatial data providers in public domains.

d. Policy and regulation

Policy and regulation are needed in order to provide legal certainty that mutually benefits both users and data providers. Generally, the preparation of these policies and regulations are intended to support the development of the NSDI in its operation. In Indonesia, the policies and regulations in the SDI implementations involve spatial data and information norms, guidelines, procedures, standards and specifications (NGPSS). Bakorsurtanal (2005) argues that the purpose of the Indonesian SDI policies and regulations are:

1. To ensure a legal certainty for business / investments in the field of surveying and mapping;
2. To ensure certainty of surveys and mapping implementation;

3. To ensure a legal certainty in the field of surveying and mapping intellectual property.

Generally, policy and regulation in SDI implementation are a substantial requirement because data and information should be protected by Intellectual Property Rights (IPR). This considers the procurement of spatial data which requires efforts in terms of financial resources, human resources and ideas to produce it.

e. Organisation

In the SDI context, the organisational component is another essential factor of the successful SDI operations. Even though much of the technology was created to solve a problem, such as a quick mapping production, the solutions cannot be accomplished without an institutional and cultural willingness to collaborate in sharing and exchanging spatial data (Williamson *et al*., 2007). The creation of cross-jurisdictions between institutions has become a priority issues for SDI implementations in every country, including Indonesia. To overcome convoluted bureaucracy across-jurisdictions, the government has a role in creating jurisdictional governance and inter-agency collaborative agreement for spatial data dissemination.

Typically, the SDI custodian with responsibility for managing spatial data has taken three primary forms: national governments, sub-national governments and private sectors (Williamson *et al*., 2007). Historically, the central government has taken controls of spatial data until the 1990s with the end of the first generation of the SDI development (Masser, 1998a). Nation states created inventories of national natural resources as part of their sovereignty over territory (Nebert, 2004), and the central government became the exclusively spatial data provider: in other words, initial SDI development was driven by 'top-down' bureaucratic approaches (Loenen, 2006).

From the beginning of the 2000s with the second generation of SDI development, the role of central government in managing spatial data has changed. SDI is driven by the needs of sub-national governments and the private sector users and their interests have greater influence (Williamson *et al*., 2007). The current generation of the SDI development is driven by a 'bottom-up' bureaucratic model (Williamson *et al*., 2007). In this circumstance, the role of national/central governments moves from being spatial data providers to facilitating spatial data strategy by legitimising appropriate policy and regulations according to SDI. The role of sub-national governments and the private sector becomes that of spatial data providers of large-scale, up-to-date, reliable and detailed information (Loenen, 2006). Relevant to this study, this component becomes the primary focus of the research to examine the efficiency of the organisational model for managing the SDI system, particularly in Indonesia.

2.4.3 Organisational framework for the implementation of SDI

The preceding chapter has explained that the SDI idea does not only consider the technical of geospatial data management, but is concerned with managerial and human elements, which are related to the organisational framework. Therefore, this section will examine insight study of organisational concept regards SDI.

a. An organisational concept for spatial data sharing and exchange willingness

Empowering spatial data sharing offering amongst various actors with different interests might be seen as being controlled by incentive and impediment factors. At the point when endeavours are made to share spatial data amongst institutions or between the divisions of a single institution, those involved regularly report that the most noteworthy hindrances to sharing are related to organisational behaviour. For example, numerous institutions have created units or corporate databases in support of their institutions' essential missions, yet few have been eager to openly permit others outside their institution to have access to or duplicate their databases, or to permit others to contribute information to them. The absence of clarification of the individual, institutional, and financial threats and rewards of sharing are shown to be significant elements influencing this outcome. Technical capacities and protections that could easily permit exchange and sharing may already exist, yet commonly are not encouraged because of institutional or individual unwillingness openness or sharing culture.

The literature on organisational behaviour includes some suggestions that offer avenues for data sharing. Perhaps the most prevalent point of view on organisational cooperation originates from exchange theory (Azad and Wiggins, 1995). In exchange theory, cooperation is an intentional exchange driven by a cost-benefit calculation: for instance, that an agency will participate in sharing data when two (or more) agencies can benefit from increased profits by doing so (Sarason and Lorentz, 1978; Cook, 1977). Levine and White (1961) are credited with the first definition of this theory as a resource-dependent model of organisational communications with its situations, and later adapted this idea for different issues like power (e.g., Pfeffer and Salancik, 1978; Boonstra and Gravenohorst, 1998) and organisational change (e.g., Boonstra, 2004; Kok and Loenen, 2005). Relevant to willingness organisation to be involved in sharing data, Boonstra (2004) also Kok and Loenen's (2005) organisational change theory offers an understanding of the power dynamics involving in changing organisational or institutional frameworks. Within it considerations, this thesis adopts both theories.

Boonstra (2004) categorises three organisational change approaches to **planned change**, **organisational development** and **continuous changing**. Each approach has a different meaning. Firstly, **planned change** aims to create economic values with a focus on formal structures and systems. This approach is driven by a top-down method of decision-making as a conscious and deliberate effort to adjust and enhance the operations of a human system through the use of scientific knowledge. It concerns how change is made, actualized, assessed, and maintained. It depends on the assumptions that the institution is in a condition of stable equilibrium and that relationships between the institutions and its situations must be kept in balance (Boonstra, 2004, pp.5).

Secondly, the **organisational development** identifies the efficiencies of the structural system by merging social and technical systems. In general, a procedure of organisational development begins with an investigation by all actors concerned with a particular issues and its solution. The necessary changes are acknowledged step by step, and the individuals from the organisations are included in all periods of the change procedure. Experts give support by contributing their experience of progress mechanism and by encouraging the change procedure and the methodology and techniques are subject alteration during the course of the changes. A coordinating and guiding framework and direction for the procedure by managers and process experts is frequently important to achieve the alterations. The organisational development approach is viable if the issue is to acknowledge upgrades inside a current setting or if there are non-routine issues which require specially designed arrangements (Boonstra, 2004, pp. 9).

Finally, the **continuous changing** approach examines the influence of interactions between people and organisations involved in a particular system. It is a synergistic approach in which everybody contributes as an expert: everyone with an interest in the issues is included in the process. The continuous changing methodology concentrates on interweaving exercises, interrelations, and sense-making. Working with what is valued encourages members to learn better how to improvise and trigger the exchange of knowledge (Boonstra, 2004, pp. 452).

Meanwhile, Kok and Loenen (2005) introduced the organisational models that adapted Boonstra's (2004) organisational change theory to describe levels of organisational maturity in relation to willingness to share and exchange information in the public domain. Kok and Loenen (2005) distinguish four stages of organisational maturity levels: stand alone; exchange and standardisation on a technical level; intermediary; and network.

- Stage I: Stand Alone

  At this level, organisational behaviour can be described as conservative, self-seeking and less willingness to transform into a different system. In terms of the SDI context, an organisation involved in spatial data diffusion is not yet ready for sharing and exchanging data in the public domain.

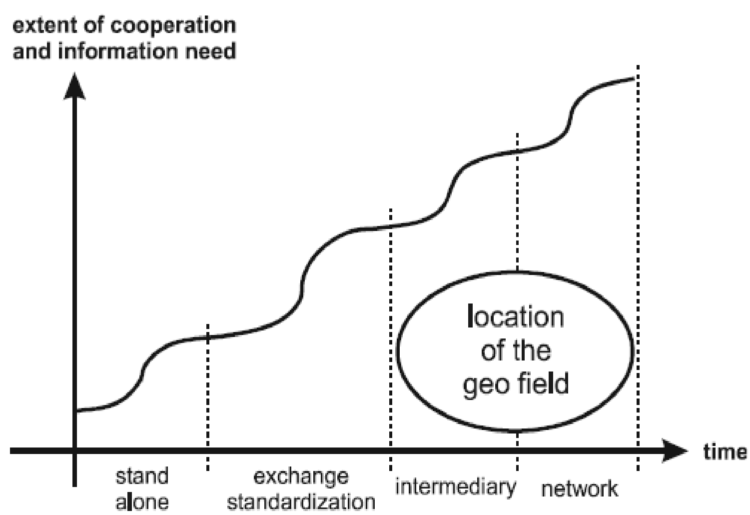
- Stage II: Exchange and Standardisation on a Technical Level
  In this stage, organisations or communities initiate collaboration over common interests to achieve short-term goals. Relevant to the SDI context, the exchange data has existed in internal groups or working units of an organisation.

- Stage III: Intermediary
  In this stage, the organisations or communities have engaged in collaboration to achieve their goals. Relevant to the NSDI, the stakeholders who participate in SDI have started to exchange data, but still existed in small groups.

- Stage IV: Network
  In this level, the organisations have a positive response to and full support for contributing to the change process. In terms of the SDI context, the stakeholders who participate in the SDI have worked with sharing and exchanging data in the public domain.

(Source: Kok and Loenen, 2005, pp.702-703)

The levels of organisational maturity in relation to SDI are shown in in Figure 2.7



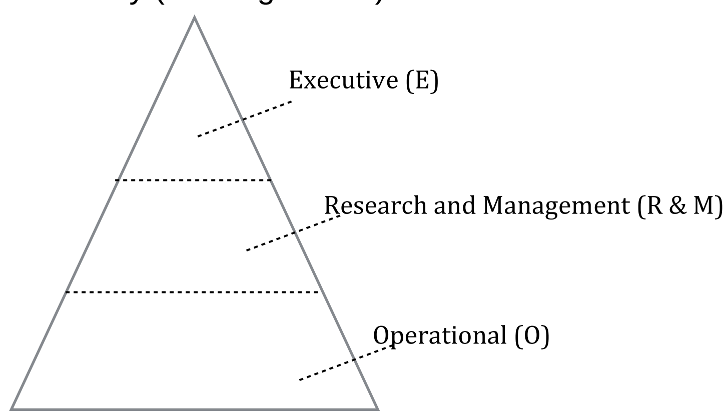
(Source: Kok and Loenen, 2005, pp.702)

Figure 2.7 The Organisational Maturity Levels in Relation to SDI development

b. Organisational management and the dissemination of spatial data

Today, Geographical Information Science (GISc) are presently viewed as widespread fields, not only concerns to technological context which is mostly discussed in Geographical Information System (GIS) subject, but also examining in organisational, human resources and policy context that mostly discussed in SDI matter. In particular, spatial databases can be seen as one of the core resources required for proficient administration. Therefore, the characteristics of organisational structure significantly influence data and information flow/dissemination in particular institutions. This section examines the relationship between organisational structure and spatial data management in understanding spatial data dissemination as the foundation of spatial data sharing, both between divisions in a single institution, and inter-agency sharing.

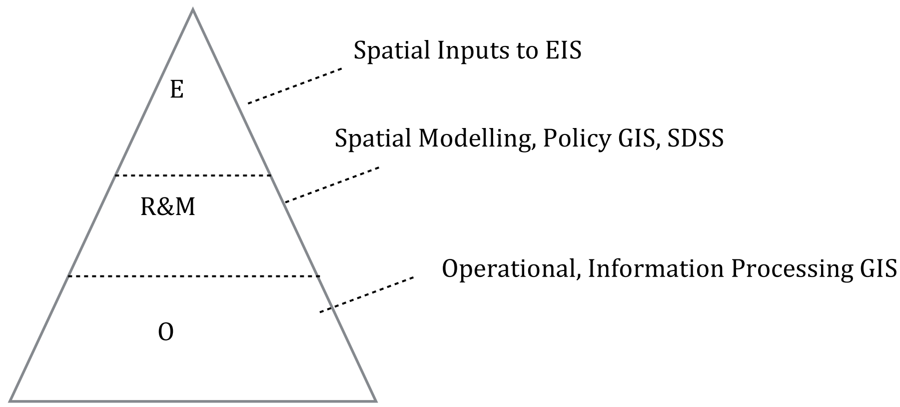
A typical organisation structure in a more general information system presents a pyramid hierarchy (See Figure 2.8)



Source: Reeve and Petch (1999, p.22)

Figure 2.8 Typical Information Organisation Structure

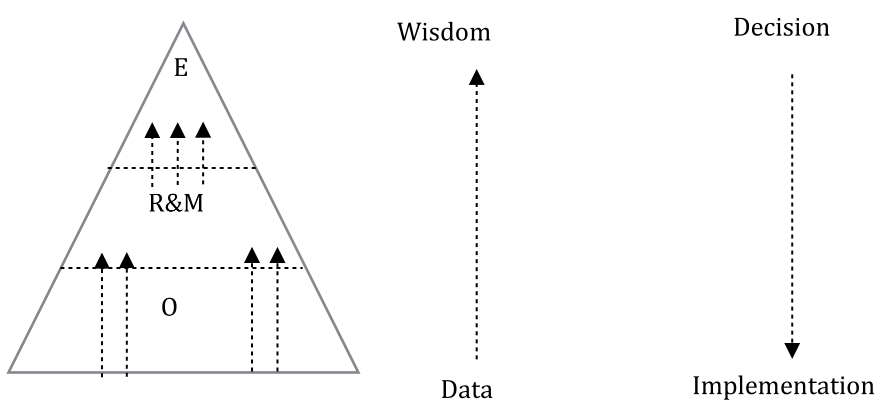
Figure 2.8 shows the typical triangular information system organisational management as three main sections. The base level is 'information operation', which produces and processes digital data. The middle level is 'research and management', which consists of managers, researchers and administrators monitoring information from the operational level, researching and preparing policy options for consideration by the top level. Finally, the top level, 'information system organisation', is the executive level, which consists of small decision-making groups determining organisational strategic directions (Reeve and Petch, 1999). Specifically, in SDI context, organisation structure of spatial data management can be illustrated in Figure 2.9.



Source: Reeve and Petch (1999, pp.23)

Figure 2.9 GIS within The Organisational Pyramid Structure

Figure 2.9 shows the base level function as operating and processing spatial data. The spatial data produced at operator level is used by managers or researchers to present spatial analyses for policy scenarios to be considered by the executive level as the decision-making group. At the top level, the executive group decides appropriate strategic planning based on the policy scenario options (Reeve and Petch, 1999). Practically, typical GIS organisational management can be presented as in Figure 2.10.



Source: Reeve and Petch (1999, pp.22)

Figure 2.10 Typical Information Flows in Traditional Information Organisation Structure

In terms of information flows, the operational level creates spatial data; middle level managers and researchers process spatial data into spatial information and spatial knowledge; and top level decision makers formulate strategic policy. A feedback from spatial information flows is policy enactment by the executive to be implemented as strategic actions in society (Reeve and Petch, 1999). Along with the embrace of the internet in governance activities, generally, GIS organisational management has developed to build communication inter-organisations (see Figure 2.11).

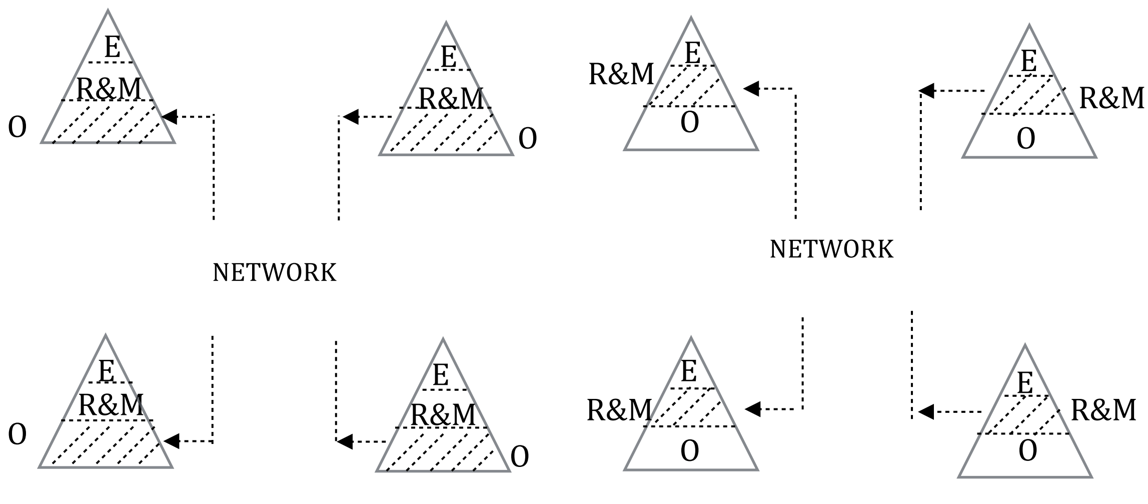


Figure 2.11 Inter-Organisational Data Sharing and Exchange

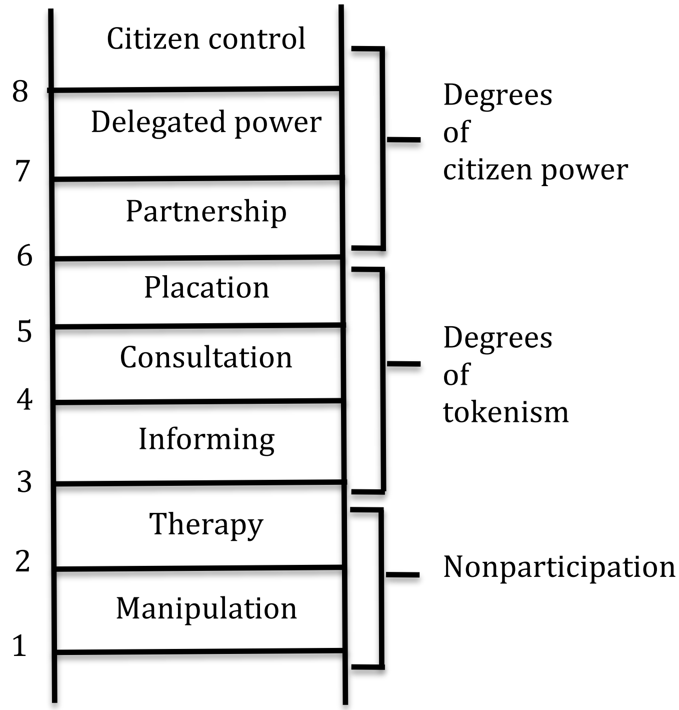
Theoretically, spatial data operators in one institution cooperate with operators in other organisations to share spatial data. Similarly, research and information managers will cooperate with other institutions to complement substantial relevant spatial information.

2.5 Underlying Fundamentals of Citizen Participation Theory and Citizen Science in Spatial Planning Processes

A complex societal systems need citizen participation to maintain their living harmony with social and environmental changes, including planning programmes initiated by governments (Smith, 1973). The rationale for citizen participation in every planning programme is even more important to enable, individuals and communities to more intimately engage with environmental modification. With citizen participation, information and judgement pertaining to local systems can provide a greater proximity and accuracy in a planning process (Smith, 1973).

Citizen participation in spatial planning can be defined as a political process to achieve social consensus between diverse interests by providing the public opportunities for dialogue with elites, such as city councils and local government representatives, planners and the community itself. Citizen participation methods can be practiced in various ways: for instance public hearings, community surveys, advisory groups and committees, focus groups, and community ombudsman/complaint centres, also participatory mapping.

Like the context of organisational behaviour, community engagement from an individual was born from a stimulus and memory (Tosi, 2008). Started from an individual memory, which are composed of beliefs, values, perceptions and experiences, evokes an individual stimulus (Tosi, 2008). This stimulus interaction triggers reacting behaviour to participate or not. In examining a community enthusiastic for a more enlightened dialogue, Arnstein (1969) offers a typology of the citizen participation. She differentiates eight levels of participation in a ladder pattern with each rung corresponding to the extent of citizens' capacity to settle planning issues (see Figure 2.12).



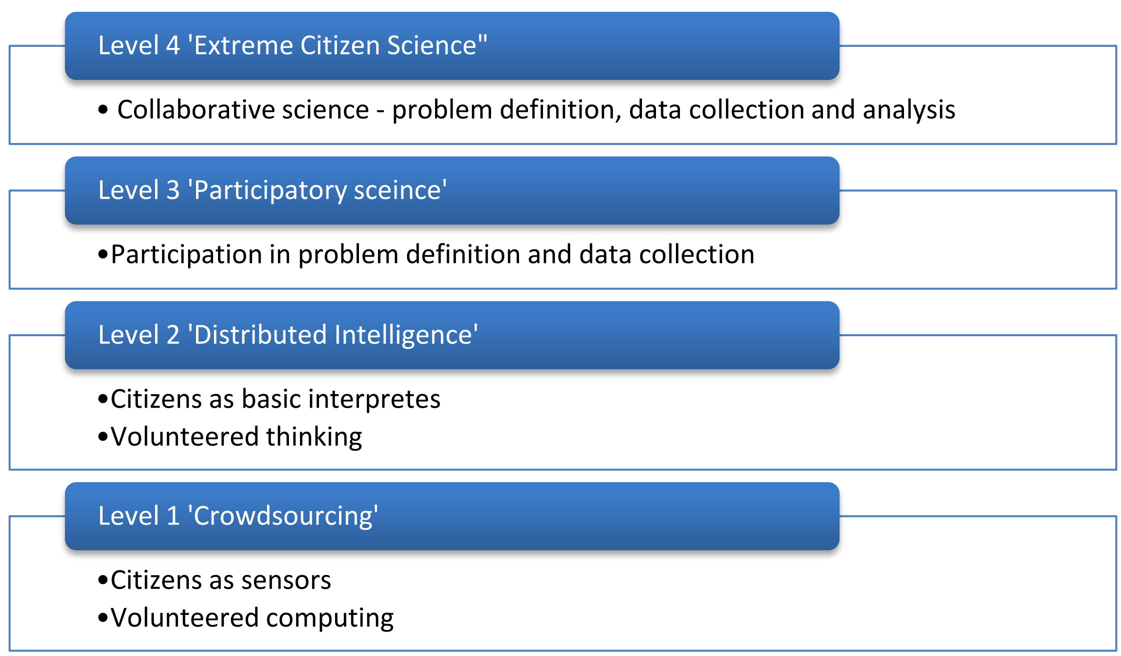
Source: Arsntein, 1969, pp. 217

Figure 2.12 Arnstein's Eight Rungs on a Ladder of Citizen Participation

The eight rungs of Arnstein's ladder of citizen participation are: manipulation, therapy, informing, consultation, placation, partnership, delegated power and citizen control. Arnstein (1969, pp.217) named the two bottom rungs - **Manipulation** (1) and **Therapy** (2) - as "non-participation". In the real projects, citizens involved in forms are not to enable participate in planning programmes, which only enable power holders to 'educate' and 'cure' the participants. The next stage, three rungs, **Informing** (3), **Consultation** (4) and **Placation** (5) are seen as "degrees of tokenism". These forms of consultation allows to have-nots to have a voice. However, in these conditions, the participants have little power to influence the programmes. However, with Placation, the ground rules admit have-nots to advise, but the power holders maintain continued right to determination. The next rung – **Partnership** (6) - allows participants to negotiate and engage in the programmes and in the next stage - **Delegate Power** (7) the spokes person or representative citizens have a significant role in assuring accountability of the programmes to their community. The top level - Rung 8, **Citizen Control** - has fully managerial power.

In current conditions of accelerated change in ever broader areas, information rapidly becomes out of date. Since citizens are directly affected by social and environmental changes, citizen participation should be practiced in the planning process, which may involve wholly new categories to update data and information, to match data held by authorities that may out of date with the updated data from citizens who interact directly with their lived environment. Hence, citizen participation may involve at managing conflict situations of local experts services (Bryson *et al*, 2013). Following Arnstein's (1969) argument the informing stage (Rung 3) in the planning process is a significant earlier phase of the development of legitimate citizen participation.

In terms of the citizen participation for providing and sharing spatial data and information, Haklay (2013) adapts Arnstein's ladder into four levels of participation and engagement in citizen science projects (see Figure 2.13).



Source: Haklay (2013, pp.116)

Figure 2.13 Haklay's Levels of Participation in Citizen Science Projects

The basic level of participation is ‘crowd sourcing’. At this level, citizen contribution limited to the provision of resources, data and information with little cognitive engagement. Volunteered computing depends on participant members who actively participate in providing data and information by carrying human sensors (i.e. vision, listening, sense of touch and sense of smell) around them and deliver back to the experiment organiser.

The next level is called ‘distributed intelligence’. At this level, the participants are asked to take some fundamental courses given by scientists or experts in data collection and elementary interpretation analysis. The level of ‘participatory science’ more deeply engages participants with scientists or experts in data collection, analysis and interpretation.

Finally, the top level of ‘extreme citizen science’ is cooperative science - an entirely joint activity, where professionals and non-professional scientist are engaged to work on an equal footing on the nature of data and information collection (Haklay, 2013, pp.116-117).

2.6 Underlying Concept of Volunteered Geographic Information (VGI)

Discussion of SDI and organisations reveals that spatial data sharing and exchange has a strong correlation with spatial data transactions between government agencies. Ubiquitous geographic information is emerging rapidly in most areas in the world. In the past, only geographers or cartographers working in government agencies could create or produce geographic or geospatial data. Now, through the use of supporting advanced devices, such as Global Positioning System (GPS), smartphones and cloud computing, geospatial data can be produced, collected, stored, disseminated, analysed, visualised and used by people with no geography or cartography background (Sui *et al*., 2013). Furthermore, Gould (1999) argues that in this digital the advances in technology and the multiple device available, which would be equipped by sensors for creating geographic features, mean that everybody can be a geographer.

Yet there has been little consideration of how spatial data or geographic information sharing practice between civil societies. Since 2006, after participatory GIS open source platforms were released, such as OpenStreetMap (OSM) in 2004, a person or groups of people with no cartography skills and working outside government agencies may create and produce spatial data voluntarily (Sui *et al*., 2013). In terms of spatial planning purposes, spatial data or information produced by local communities may help to create local spatial knowledge to support spatial policy decision-making. This situation discusses volunteered geographic information (VGI) in more detail in order to understand the underlying concept of VGI and possibilities for integration with SDI in achieving democracy in the spatial planning context.

2.6.1 Characteristics of VGI

VGI has the possibility to be a useful democratic planning tool to empower citizens participating in spatial data provision and sharing in government programmes (Johnson and Sieber, 2013). Since the global emergence of World Wide Web (WWW) technology, the interaction between information providers and users has increased. Local communities are able to produce and share spatial data to produce web interfaces with territorial information in mapping application programming interfaces (APIs) public, such as Google maps, OSM and Wikimapia (Rouse *et al*, 2007; Goodchild 2007; Tulloch, 2007).

In terms of the democratic spatial planning action, VGI is considered an effective voluntary method of helping people feel comfortable with the technology and other co-participants in order to shape coalitions of local knowledge (Craig and Elwood, 1998). However, this voluntary behaviour of VGI communities raises critical questions about individual motivations for contributing to spatial data production and sharing.

Coleman *et al.*, (2009) identified the following 10 aspects of the VGI voluntarily behaviour:

- *Altruism*;
- *Professional or personal interest;*
- *Intellectual stimulation*;
- *Protection or enhancement of a personal investment*;
- *Social reward*;
- *Enhanced personal reputation*;
- *Outlet for creative & independent self-expression*;
- *Pride of Place*;

And, on the negative side:

- *Mischief;*
- *Social, economic or political agenda; and*
- *Malice and/or criminal intent.*

Source: Coleman et al., (2009, pp. 343-345)

VGI uses sharing and exchange of spatial information activities to interact with other stakeholders to create spatial narratives (DiBiase *et al.*, 1992). Within this perspective, VGI may contribute creating local spatial knowledge by examining, synthesizing and formulating spatial data and information related to communities' neighbourhood issues (Elwood, 2006). However, notwithstanding that VGI is a useful approach to empower local stakeholders in terms of spatial planning, VGI participants from different professions, ages and education levels may degrade data quality performance: for instance, data may be less accurate or use non-standardised geo-referenced systems.

2.6.2 Assessment of the Quality of VGI

Since 2002, the quality of geographic information has been regulated under International Organisation for Standards (ISO): Code 19113 examines the quality principles and Code 19114 considers the quality of evaluation procedures. Both of ISO Codes are organised under the aegis of ISO Technical Committee 211 (Haklay, 2010). Today, both ISO catalogues have been revised and merged into one ISO catalogue – ISO 19157:2013 of data quality. The quality standards of geographic information assessment based on ISO: Code 19157:2013 have been categorised into eight groups: completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy, purpose, usage, and lineage.

The assessment of the quality of VGI generates debates, and as yet, there is no consensus about mechanisms or methods (Antonio and Skopeliti, 2015). However many geography scholars have tried to measure the quality of VGI in their own approaches using ISO standard parameters: for instance, Haklay (2010) and Coleman *et al.,*(2009) generally reveal that the quality of VGI is varied. VGI established by international reputation, such as OSM, Wikimapia and Google Map Maker has higher accuracy (with less than 10% of error accuracy) than VGI established under local reputation that exist in one nation. Overall, however, it is suggested that VGI organisers/administrators should have geography or cartography backgrounds in order to edit, manipulate and revise error geographic features to be more accurate.

2.6.3 The Value of VGI

The value of VGI can be evaluated from two perspectives, the participants of VGI community; and geographic information that is produced, provided, disseminated and shared amongst communities and other stakeholders, such as governments and planner professions.

Considering to the participants of VGI groups, the main value of VGI can be identified as contributing to a democratic system. VGI works by empowering citizens to create geographic information which will provide spatial data or information to improve government policy decision-making. VGI can:

1. Foster a bottom-up participation approach in planning processes by allowing citizens' control over their own living places (Feick and Roche, 2013);
2. Improve social networks and individual technical skills amongst VGI community members (Feick and Roche, 2013)
3. Share data amongst local VGI communities to create local spatial knowledge. Local communities can understand and manage their own areas better data and information created by local communities can be

evidence and tools for negotiation with government over planning and development agendas (Roche and Caron 2009; Obermeyer, 2006).

The value of VGI for spatial data or information production can be listed as follows:

1. Spatial data or information that produced, provided, stored and disseminated by VGI communities will have primarily latent value when used an applicable issue and cognitive task. (Feick and Roche, 2013). A single type of data might be used in various techniques, sometimes when mixed with other data, which are then jointly referenced or analyzed in unique methods, combined data producing new information (Longhorn and Blakemore, 2008).
2. Second, information is a non-physical product that frequently relates *a de facto* public good since use by one individual does not inhibit others' use; in any case, use limitations ensuing to license agreements, copyright and confidentiality concerns sometimes imply that it can approximate *a de jure* private good (Feick and Roche, 2013)., and
3. With a large number of VGI participants, the spatial data or information created by VGI communities may be far more responsive to creating local spatial knowledge than governments or private firms, which may lack of necessary budgets, resources and time. For instance, when the particular area has had a disaster, OpenStreetMap may give quick responses by involving the global VGI community to participate in immediate updating data (Goodchild and Glennon, 2010).

2.6.4 Criteria for monitoring crowd-sourced information in VGI

Influential enthusiasm from citizens to be involved in participatory planning in VGI context may create a revolution in formulating spatial planning policy from a bottom-up approach. However, there are critics of volunteering innovation to create a democratic atmosphere in spatial planning. Some VGI scholars like Keen (2007), Lanier (2006) and McHenry (2004) argue that crowd-sourcing geographic threatens the legitimate official institutions in spatial policy decision making.

In response to critics of crowd-sourced geographic information critics, Coleman et al., (2009, pp.337-338) suggest five VGI ways to control crowd-sourced geographic information transactions in open data situations. The criteria deal with

1. ***Neophyte*** - Somebody with no formal foundation in cartographic skills or geographic subject, however having the interest, time, and ability to contribute producing spatial data;
2. ***Interested Amateur*** - Somebody who has recognised their enthusiasm in spatial data and information, started to learn the basic cartographic and geographic information skills, consulted with other partners and experts about geographic information science issues, applying what they have learned directly on the GIS platform;
3. ***Expert Amateur*** - somebody who may know a great deal of cartographic and geographic information subject, exercise it enthusiastically on occasion, yet at the same time does not depend on it as a profession;
4. ***Expert Professional*** - somebody who has considered and put an edge on cartographic and geographic information subject, depends on that learning as a profession, and might be sued if their suppositions and/or proposals are demonstrated insufficient, inaccurate or offensive; and
5. ***Expert Authority*** - somebody who has generally considered and for some time, honed a cartographic and geographic information subject to the point where he or she is perceived to have a set up record of creating high-quality spatial data and administrations and/or very much actively to be involved in expert sharing sessions. This person stands to lose that status, and maybe even their employment, if that credibility is lost, even accidentally.

There is much value to be gained from in researching the favourable circumstances, uncertainties and crucial procedures and protections connected with including more extensive collecting data and information in keeping up, overhauling and updating legitimate databases with suitable procedures set up, VGI speaks to facilitate the processes of change taking place in any particular location and, in future, make better databases with upscaling naming and characteristics. Coleman et. al., (2009, pp.340) categorise four connections and purposes in which people deliberately contribute spatial data and information

2. ***Mapping and Navigation*** – where the objective might be a commitment to an open guide arrangement (e.g. the USGS National Map Corps) or a database supporting a route or directing services (e.g. Waze, Tomtom, NAVTECH, Tele Atlas);
3. ***Social Networks*** – where the commitment might be made to map a particular site (e.g. OSM, WikiMap);
4. ***Civic/Governmental*** – where the commitment underpins some actions which are concerned with public needs of particular areas (e.g. Public Participatory Geographic Information Systems (PPGIS));
5. ***Emergency Reporting*** – where the commitment bolsters the reporting of the potentiality and size and degree of natural and human-made catastrophes. (e.g. Humanitarian OpenStreetMap Team (HOT)).

The relationship between VGI participant criteria and VGI purposes can be depicted in the following table.

Table 2.3: The Relationship Between VGI Participant Criteria and Purpose

	Mapping and Navigation *(Example: GPS-based Car Navigation)*	***Social Networks*** *(Example: OpenStreetMap)*	***Civic/ Governmental*** *(Example: PPGIS)*	***Emergency Reporting*** *(Example: Disaster Reporting)*
Neophyte	*Relies on unit to provide directions and follows instructions to add basic point*	*Identified gaps in map coverage, familiar with the locale, and has obtained the requisite GPS*	*Views a GIS map in a town hall meeting around the siting of a power plant in the town*	*May use cellphone to add a basic information detailing location of a potential new*

	information using the Unit.	*equipment. Interested in making a first contribution.*		*wildfire outbreak.*
Interested Amateur	*Owns a personal system, uses it extensively, has made several contributions. Is aware of both technology strengths & limitations and procedures required to make reliable contributions.*	*Owns the equipment; familiar with data editing software & processes. Regular contributor of edited map data and may assess other contributions.*	*Citizen fashions a map to present a counter claim in a town hall meeting around the siting of a power plant in the town*	*May drive from place to place shooting geotagged photos showing extent of floodwaters*
Expert Amateur	*Familiar with the strengths and weaknesses of multiple systems, has owned more than one. May assess and occasionally amend the contributions of others.*	*Expert with the requisite equipment. Regularly assesses & edits contributions from others. Participates in specification development & decision-making*	*Individual familiar with conditions in a given neighborhood and with the operation of the Webbased PPGIS system in use.*	*Familiar with requirements for data useful to emergency response personnel and may voluntarily travel to sites to provide such information on an "on-call" basis*

Expert Professional	*Mapping or Location-Based Services professional.*	*Mapping or Location-Based Services professional.*	*Practicing Urban Planner*	*Emergency planning and/or response personnel tasked with mapping the position and geographic extent of a given flood or wildfire.*
Expert Authority	*Specialist consulted by other professionals re: specific problems and/or new developments.*		*City Planner with extensive knowledge of developments in the area of interest.*	*Specialist consulted by other professionals re: specific problems and/or new developments.*

Source: Coleman et. Al., (2009, pp.341-342)

2.7 Summary of Chapter

Spatial data has a significant role relevant to the planning process as a geographical visual communication between all stakeholders in achieving consensus in selecting priority development agendas. However, even though spatial data benefit the planning process, they will become impediments unless there is access, commitment and participation by all stakeholders. SDI is intended to involve all stakeholders who contribute to spatial data activities at different levels of jurisdictions. However, the mechanism is not only to collaborate by sharing and exchanging data, but also to produce better spatial data management; reduce costs; and interact with technology to achieve consensus amongst multi-level government and other stakeholders (i.e. private sectors and local communities) who share similar interests in particular development areas, and specifically in spatial planning processes.

Since the internet went public in the 1990s, significant data and information provision and sharing relevant to spatial phenomena have created a new social form of knowledge-diffusion and problem-solving in the spatial planning domain (Papadopoulou and Giaoutzi, 2014). Many professionals and scientists, including planning and geography scholars, have adopted web technologies to enrich and facilitate the decision-making process.

In the digital age through the support of advanced devices, (viz. Global Positioning System (GPS), smart phones and cloud computing), geospatial data can be produced, collected, stored, disseminated, analysed, visualised, and used by anyone regardless of their lack of geography or cartography background (Sui *et al*., 2013). A person or a group of people who has been untrained for cartography skill, but voluntarily creates geographic information is called Volunteered Geographic Information (VGI) (Goodchild, 2007). The challenge for the integration of official spatial data and crowd-sourced spatial data is a communication amongst actors in the spatial planning context.

The underlying democratic intent of spatial planning processes relevant to spatial data sharing understanding of the causes of data sharing amongst actors. The philosophical approach of this research and refining the research conceptual framework are considered in the following chapter.

CHAPTER 3

CONCEPTUAL FRAMEWORK

3.1 Introduction

This chapter discusses the conceptual framework of the research. This provides the underlying context for understanding spatial data sharing between government agencies and citizens in spatial governance processes for spatial planning purposes. It is very much in the interest of this research to establish a research paradigm in spatial data development and sharing, as well as identifying primary research approaches to how government agencies and citizens can enhance democracy through spatial data sharing.

The chapter is divided into four sections. The first section presents the research paradigm in examining spatial data development and sharing. The next section explores a conceptual strategy to create inter-agency spatial data sharing. This is followed with a discussion on the essential elements of inter-agency spatial data sharing. The final part of this chapter examines spatial data co-production between government agencies and citizens.

3.2 A research paradigm to examine spatial data development and sharing

A research paradigm is a substantial model or reference framework that scholars use to organise their observations and interpretations. It locates underneath of theories. Kuhn (1962) defined the research paradigm as

"*the set of common beliefs and agreements shared between scientists about how problems should be understood and addressed*", Kuhn (1962, p.45).

Furthermore, Guba and Lincoln (1994, p.107) argued that a research paradigm can be characterised into three basic belief systems, namely ontology, epistemology and methodological assumptions.

An ontology is a various levelled organisation of knowledge, similar to a lexicon or glossary, yet with more noteworthy detail and structure. An ontology comprises of concepts, axioms and relations in processing knowledge (Lee *et al.*, 2004). The implication of ontologies in the information sciences, including geographical information science, can be seen, on the methodological side, through the appropriation of a profoundly interdisciplinary way to deal with philosophy improvement, while on the architectural side, in the part that a metaphysics can play in an information system, it can be seen through prompting the point of view of ontology driven information systems (Guarino, 1998).

Epistemology is an aspect of philosophy that addresses the knowledge, source, meaning, and also truthfulness of information (Audi 2011; Steup 2005). It leads to a consideration of how we come to distinguish what is valid from what is false and how we comprehend the conditions under which such distinction is conceivable and important. In relation to the study of geographic information systems, epistemology is relevant to understanding of data development and assessment precision or accuracy (Sieber and Haklay, 2015).

Methodology in a simple description can be defined as a set of tools, principles and rules for scholars to examine research to generate knowledge in the arts or sciences. The methodology of this thesis are examined in details in Chapter 4.

The Information Systems (IS) field, including GIS, gives attention to the plan and administration of information and communication technologies (ICT) in organised human activities. As far back as the origin of the IS field in the 1970s, IS scholars and professionals have scrutinized the field's essential precepts, substance, philosophical structures, techniques and functional importance in many articles. This reflexivity is seemingly in charge of the ontological differing qualities and theoretical lavishness of the field as well as for current advances made in theorizing the manufacture of information infrastructures (Georgiadou *et al.*, 2009).

In terms of research paradigm in IS fields, Orlikowski and Baroudi (1991) examined 155 articles published in the 1980's and summarized with a call for more ontological diversities in IS study. They examined key ontological parts of positivism in the natural sciences and their significance to information system researches. The positivism paradigm in most SDI and VGI research may help in understanding spatial data and information usage, when the geographical, economic, social, authentic, experiential "separation" is irrelevant. In some cases, for infrastructural information systems, such as SDI and VGI, that traverse various settings spread out all around, the select dependence on positivism is probably not going to give rich bits of knowledge of how diverse performing actors strike and manage an element, regularly shaky harmony between worldwide consistency and local contextual solving (Georgiadou, 2006).

In the 1990s, IS scholars proceeded onward to various ontological bearings and cross-preparations with different fields and scholarly points of view. More reviews took after what is known as an interpretative research philosophy, for the most part with the assumption that socially significant realities and things are socially built, a few with an observational premise including GIS frameworks (Georgiadou *et al*., 2009).

Taking up the savvy work of Orlikowski and Baroudi's (1991) and the perspective of Georgiadou *et al*., (2009), the researcher contends that interpretive paradigm has an incredible arrangement to offer to investigations of potential integration of SDI and VGI. Considerably more essentially, potential SDI in accommodating VGI in this research exploration has an extraordinary arrangement to offer to IS research for two reasons. Firstly, the observational setting of SDI marvels is prevalently public governance and not the corporate circle, while the recent theoretical records of information infrastructures in IS studies have risen up out of the exact premise of worldwide private enterprises and widespread infrastructures (specifically, the Internet). Secondly, the public good nature of SDI offers chances to see how the properties of comprehensiveness and non-contention of public goods are socially developed.

In summary, the research paradigm of this thesis can be depicted in Table 3.1

Table 3.1 The Research Paradigm of The PhD Thesis

Paradigm	**Ontology**	**Epistemology**	**Methodology**	**Method**
Interpretivism/ Constructivism	Reality exists and has been generated by directed social construction	Understanding oppressed view by revealing the conflicting states of activity which are covered up or misshaped by regular comprehension and work to assist change social circumstances	Grounded Theory	Qualitative Research by implementing triangulations: • Observation • Interview respondents • Document analysis

3.3 A conceptual strategy to create spatial data sharing alliances in the context of spatial governance

Various Information systems scholars acknowledge that achieving good organisational performance requires equal vision and mission amongst members (Mähring et al. ,2004; Doherty and King, 2001; Lambert and Peppard,1993;

Williams, 1997 ; Suomi, 1994). Specifically, Budhatoki and Nedovic-Budic (2007) argue that the essential point of data or information sharing in an organisation performance factor is an inter-organisational Collaboration-Cooperation-Coordination (3C) element. In relation to this, this section will examine the broader 3C concept and its relevance to spatial data development and sharing in spatial planning process.

3.3.1 Collaboration

Collaboration gives an opportunity for sharing learning, background and aptitudes with various individuals, keeping in mind the end goal of altering objectives and creating improvement. Within a specific end goal to effectively work together, there must be adequate assets, a society that energizes compelling collaboration and participation and in addition clearly understood obligations (O' Flynn and Wanna, 2008; Ramjit, 2011).

Moreover, colleagues involved in collaboration must trust and respect each other. There must be open correspondence and readiness to acknowledge information from others. Since in all groups there are clashing objectives, decision-making must take place through cooperative methods. Collaboration guarantees that no one individual, gathering, association or foundation is completely accountable for anything; rather, all are included and bear a measure of obligation (Denise, 1999) (Characteristics of the collaboration and the relationship with cooperation and coordination can be seen in Figure 3.1).

With relevance to the context of this research, collaboration amongst authorised and non-authorised inter-organisations that produce and manage spatial data can create willingness for each organisation to share their knowledge and assets in data and information in a commitment to the obligation of achieving a nation aim. Therefore, collaboration is one of the essential elements necessary to achieve successful potential integration of SDI and VGI in supporting the spatial planning process.

3.3.2 Cooperation

Cooperation is depicted as a casual relationship without a typical mission in which data or information is shared on ‘an as-required’ premise, power stays with every association, there is little (or no) danger assets are kept separate. Furthermore, inter-organisational partnership includes assets, abilities and skills in the quest for common enthusiasm for the achievement of the organisations’ goals (Ramjit, 2011; Denise, 1999).

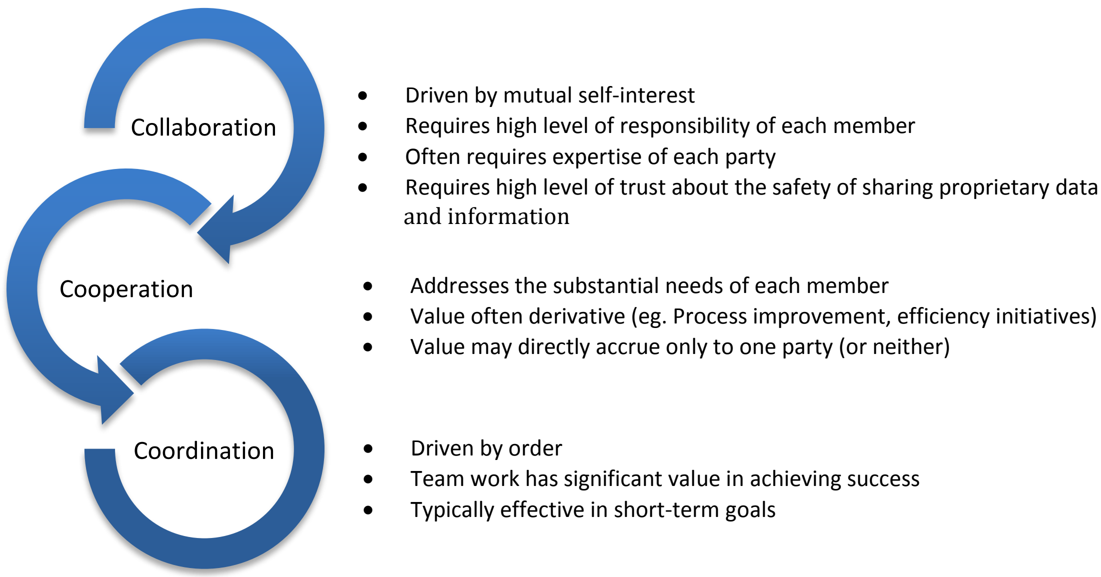
The amalgamation of data and information production with marketing or dissemination is a type of joint advantage, central to achievement (Gulati, et al., 2012). In terms of this research, cooperation amongst authorised and non-authorised inter-organisations that produce and manage spatial data can create commitment to the obligation of achieving a nation aim, in this case, achieving coherent spatial planning programmes at different levels (Characteristics of cooperation and the relationship with collaboration and coordination can be seen in Figure 3.1).

3.3.3 Coordination

Coordination suggests understanding the dependencies between the responsibilities the various class representatives are performing and the way the class coordinates their duties (Crowston, *et al.*, 2006, pp.1). Coordination ensures that all specialists and divisions recognise what and when they have to accomplish. Along these lines, work starts with one office then onto the next without hindrance.

In any association, nation or activity, all individuals must be organised in such a way as to guarantee that general vital aims are accomplished and every individual makes a commitment. Therefore, coordination has an essential point in an organisational performance. Every single departmental arrangement and spending plans must be facilitated to guarantee they are cooperating to accomplish agreed goals (Denise, 1999)(Characteristics of the cooperation and the relationship with collaboration and coordination can be seen in Figure 3.1).

In this study, coordination amongst authorised and non-authorised inter-organisations that produce and manage spatial data can integrate, synchronize and simplify the different tasks on an ongoing basis to achieve effective and efficient spatial planning.



Source: Modified from The Economist Intteligence Unit 2008 in https://www.trinityp3.com/2012/08/did-you-want-collaboration-cooperation-or-coordination-with-that-marketing-process/

Figure 3.1 Characteristics of Collaboration-Cooperation-Coordination (3C) and The Relationships of 3C Elements

The 3C concept is helpful in creating an inter-organisations (authorised and non-authorised) partnership to develop and share spatial data at the macro scale. However, this concept needs an organisational epistemology in terms of how inter-agency partnership can be enthusiastic about sharing their data and information knowledge assets. The next session will discusses this issue.

3.4 Essential elements of spatial data sharing inter-agency alliances

Often, the integration of an institution's structure and operations has brought about disruption of work flows and individual responsibilities. Conversely, such discontinuity tends to increase the power and reach of their positions holding such knowledge since such specialists and associations regularly control the data or information that is essential, worthwhile and exclusive.

Olson and Zeckhauser (1966) and McGuire (1974) proposed that even when individual (or institutions) are destitute of feelings (either positive or negative) toward each other, they may discover that it is in their interest to coordinate for the aim of providing common things. Within this consideration, Obermeyer and Pinto's (2008) proposed 3 essential elements that inter-agency alliances can be occured, they are appeals to professionalism, coercion, and bargaining.

1. **Appeals to professionalism**

   In particular circumstances, appeals to professionalism illustrate an engagement with some degree of altruistic honorable qualities.

2. **Coercion**

   The second means by which inter-agency cooperation can occur is through pressure. In a few instances, intimidation can be a method of controls of one level of government by some more capable level of government.

3. **Bargaining**

   Within the essential idea of bargaining, institutions have an assortment of assets available to them. In some instances, data or information exchanges may be conceivable. A few associations may have the financial assets to buy data or information from different agencies or to give some other in-kind non-financial considerations.

Source: Obermeyer and Pinto (2008, pp. 190-191)

Obermeyer and Pinto (2008) illustrate the relationship of the three essential elements for achieving successful inter-organisation data and information sharing between the owner of information and the seeker of information in the distribution of power and strategies model to achieve information-sharing alliances (See Figure 3.2).

		Owner of Information	
		Powerful	Powerless
Seeker of Information	Powerful	**Bargaining**	**Coercion**
	Powerless	**Appeal to Professionalism**	**Bargaining**

source: Obermeyer and Pinto (2008, pp.192)

Figure 3.2. Distribution of Power and Strategies to Achieve Information-Sharing Alliances.

Figure 3.2 suggests that organisations will look for the least expensive strategy in terms of time, money and energy. The two minimum expense relations are coercion and appeals to professionalism. Coercion is accessible only to associations that have the force or power to use it. On the other hand, appeals to professionalism are accessible to everybody. The equalization of force supports the seeker of data or information; an association may apply its power and request the data or information from the weaker owner of the data or information.

When power relations support the data/information owner, the weaker data/information seeker has neither the power available to request the data nor the expected force to take up a bargaining position. When the data seeker is generally weak, it must depend on engaging altruistic ideas of professionalism and the public good. Bargaining occurs only when both the owner and the data/information seeker have generally identical power, despite the fact that it has little effect of value and norms in each actors if both are moderately capable or generally feeble (Obermeyer and Pinto, 2008).

Overall, Obermeyer and Pinto's (2008) model of the distribution of power and strategies to achieve information-sharing alliances is useful for exploring the willingness of institutions to develop, provide and share data or information, and this approach adopted in this research.

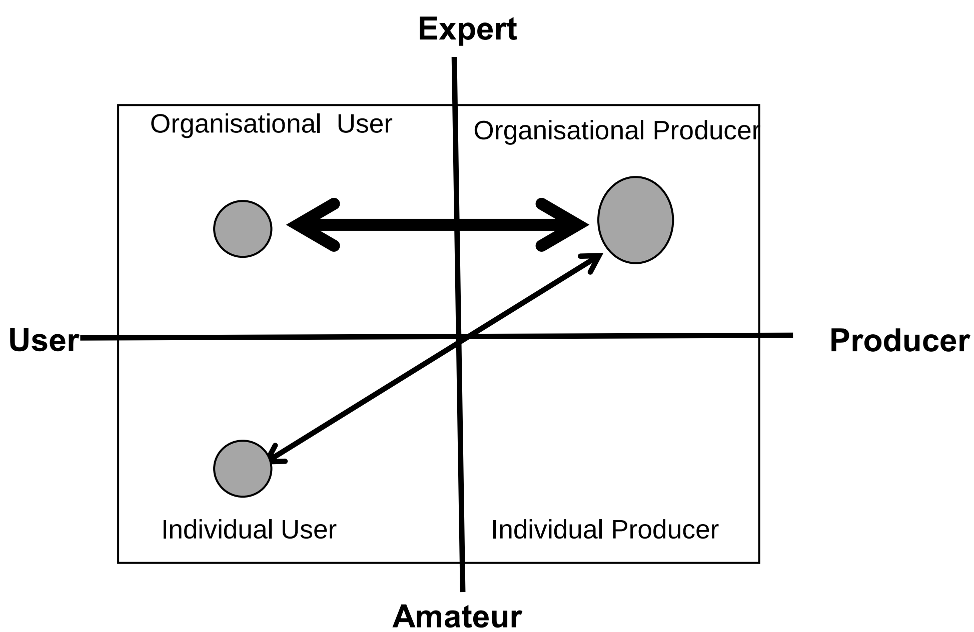
The aim of this thesis is to suggest a new approach to enhance more democratic planning by implementing spatial data development and sharing involving central, province, municipality and regency government, and civil society. It investigates official spatial data development accommodating crowd-sourced geographic information. This framework needs to be refined in order to apply it to spatial planning processes in the Indonesia context. The development and application of ideas from the existing academic literature needs to be based on an understanding of a clear spatial data management conceptual framework. This is discussed in the next section.

3.5 Spatial data co-production between government agencies and citizens

Varyious scholars have studied typical organisational and collaboration management (Child *et al*.2005; Lorange *et al*. 1992; Axelrod 1984). Their studies have focused on the nature of organisational behaviour rather than on in-depth examination of particular factors. Research relevant to organisational management in the NSDI context has been developed by several SDI scholars, such as Dessers *et al.* (2009); Masser (2005); Rajabifard *et al.* (2003b). In order to examine and understand the mechanism of organisational bureaucracy, they have focused on top-down mechanism for successful NSDI implementation. In practice, their approach is limited to understanding to what extent the NSDI mechanism can accommodate a bottom-up VGI approach.

Currently, citizens in many countries voluntarily disseminate spatial data using social media networks, which correlate with VGI. Practically, the VGI mechanism provides immediate up-to-date spatial data contribution. However, these applications do not replace the need for official spatial data control. Therefore, accommodating VGI in a NSDI framework is a possible future scenario for spatial data being much more widely available online (global) from private sector actors.

Several scholars have explored the potential integration of NSDI and VGI relevant to national spatial data management, (for example, Sutherland *et al* (2013); Miranda *et al* (2011); Coleman (2010); Budhathoki *et al* (2008); Goodchild, (2007); and Craglia (2007). However, their studies mainly discuss potential general issues of the NSDI and VGI integration rather than a specific model for appropriate NSDI and VGI organisational management. The exception are Budhathoki *et al*. (2008) who have created a model of spatial data co-production for national spatial data management. To fill the knowledge gap concerning the organisational bureaucracy needed for NSDI implementation, this study adopts Budhathoki's *et al*'s reconceptualise NSDI and VGI integration model in the spatial planning process. Budhathoki *et al*. (2008) illustrate typical worldwide spatial data dissemination from producer to user as shown in Figure 3.3.

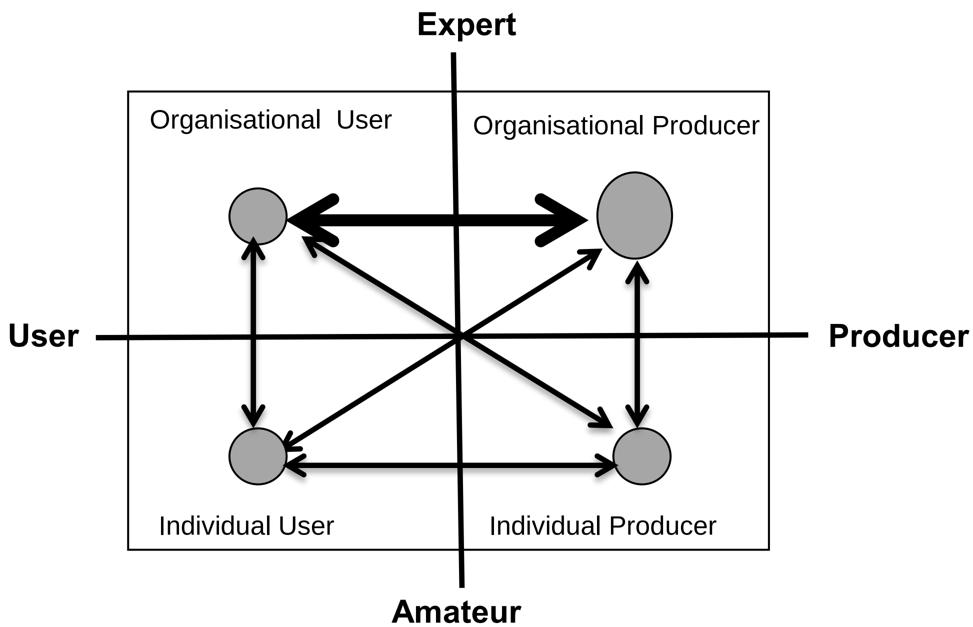


source: Budhatoki *et al*. (2008, pp.155)

Figure 3.3. Typical Producer-User Spatial Data Dissemination

Figure 3.3 shows how spatial data dissemination is implemented in common situations. It is clear that spatial data and information are provided by expert organisational producers which are usually led by national mapping agencies

(NMA). Spatial data dissemination flows from a formal and a top-down environment that mainly distributes to expert organisational users, for instance the Planning Board, and distributes less to amateur individual users. Organisations and individual users contribute by sharing their local spatial knowledge with organisational producers, but individual producers do not have an influence regarding spatial data dissemination. Thus, Budhathoki et al. (2008) suggested a re-conceptualised the role for the spatial data infrastructure user by accommodating all equal-level stakeholders in the context of co-production, as presented in Figure 3.4.



source: Budhatoki *et al*. (2008, pp.156)

Figure 3.4. Budhatoki's *et al*'s Producer-User Spatial Data Dissemination Model

The reconceptualization of the spatial data users sets up a two-way interaction between spatial data producers and users, which reduces the division between them. Since agency or individuals in any quadrant can produce and share spatial data with others situated in any other quadrant, all stakeholders are associated with each other.

This implies the generation capacities are extended from official institutions to public organisations and individuals. In like manner, the spatial data users' roles extend from beneficiary to producer. The spatial data producer may innovatively utilise, share, and additionally create spatial data autonomously or in a joint effort with others. Furthermore, the spatial data producer is not constrained by the association; people and communities can likewise partake in spatial data creation and supply.

Theoretically, Budhathoki's ideas of empowering all stakeholders in spatial data sharing and exchange have appropriate concept. However, the researcher argues, if this concept is implemented in real practice, the SDI concept could be putted at risk due the poor quality of spatial data and information, for instance, less accurate and reliable data. To overcome these negative implications, the study proposes a new potential reconceptualisation of the SDI and VGI organisational management integration model, as shown in Figure 3.5.

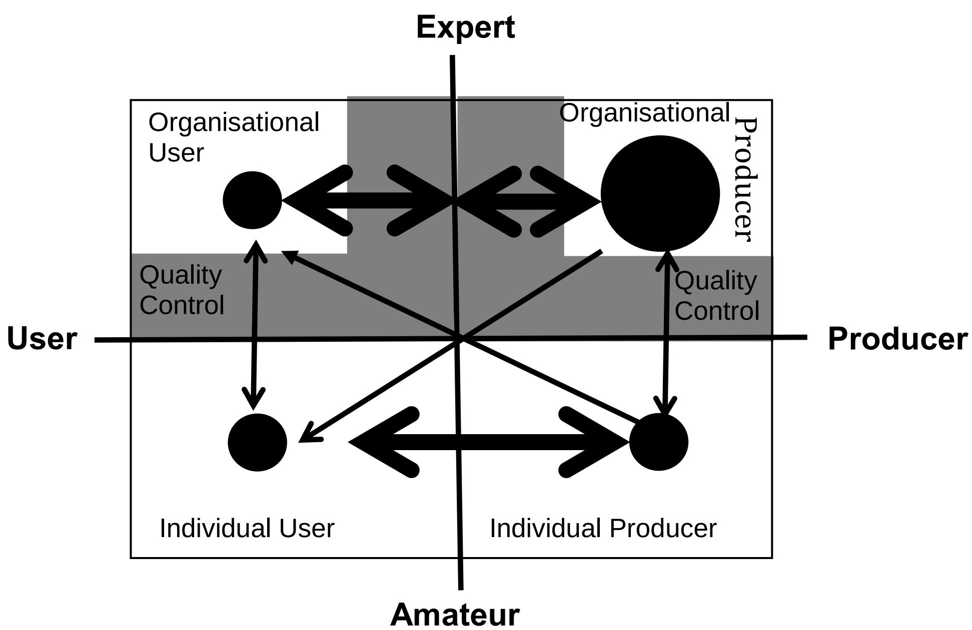


Figure 3.5 Potential Re-conceptualisation of SDI and VGI Organisational Management Integration Model Suggested in This Study

It can be seen from figure 10 that the new concept has some similarity with Budhathoki's ideas of empowering all stakeholders in spatial data sharing and exchange in Figure 3.4, however, it differs in its the organisational level: there is an additional aspect, i.e. Quality control management to keep monitor the quality of spatial data and information pertaining to SDI standards. Furthermore, spatial data flow from the organisational producer to the individual user level and from the individual producer to the organisational user is limited to one-way direction only. It is due to the objective to maintain the spatial data quality.

3.6 Summary of Chapter

The study of geographic information knowledge, includes spatial data sharing, and created based on experiment and fieldwork observations relevant to positivist and empiricist perspectives. This research uses both perspectives to study the potential for spatial data integration management between government agencies and citizens in supporting spatial planning processes in Indonesia.

Various information system scholars acknowledge that an organisational performance factor requires successful information system implementation and management in society (Mähring *et al*. ,2004; Doherty and King, 2001; Lambert and Peppard,1993; Williams, 1997 ; Suomi, 1994). Specifically, Budhatoki and Nedovic-Budic (2007) argue that the essential point of data or information sharing in an organisational performance factor is an inter-organisational collaboration-cooperation-coordination (3C) element.

The theoretical considerations for spatial data sharing and underlying organisational management of spatial data sharing have been discussed in this chapter. The next chapter discusses the research methods necessary to convert these conceptual framework into issues that can be researched in the context of Indonesian government system.

CHAPTER 4

METHODOLOGY

4.1 Introduction

Chapter 3 sets out a conceptualisation of spatial data sharing based on a philosophical approach, the conceptual strategy of inter-agency alliances in data sharing, the essential elements of inter-agency spatial data sharing as well as underlying spatial data co-production between official agencies and citizens. The next stage of the argument is to translate the features of this conceptual framework into a research strategy and set out the sequence of research activities.

The study of SDI and VGI has been carried out by various geography and planning scholars. However, a study of SDI and VGI integration for particular purposes is less common and SDI and VGI integration theories still developing. To contribute to the study of SDI and VGI integration, the researcher decided to use grounded theory as the methodological approach in this research.

A grounded theory approach is an appropriate method to investigate empirical observations of general knowledge of the particular social phenomenon. Creswell (2003) argues that grounded approach assists academics to clarify a mechanism when a theory is not accessible. It clarifies how organisations and communities are encountering a marvel by exploring their perspectives, activities and connections. Since this research deals with a relatively new phenomenon, grounded theory is a suitable method to use.

The growing interest in building theories from empirical research or a case study is being manifested in the social sciences field (Onatu, 2013). A case study focuses on describing, understanding, predicting and/or controlling the individual case (Woodside, 2010). Many researchers (for example, Campbell and Fiske (1959);

Denzin (1978); Knafl and Breitmayer (1989); Leedy (1993); Mitchell (1986); Sohier (1988); and Webb *et al*. (1966) notes that in case study research, multiple research methods should be employed across multiple time periods - frequently called the triangulation method. Woodside (2010) distinguishes aspects of triangulation as follows:

(1) Conducting direct observation in the case study environment;
(2) Asking participants to examine and interpret data and information;
(3) Analysing written documents relevant to the case study.

This chapter will examine various methods leading to support why qualitative method is appropriate in this study. Overall, the methodological approach in this chapter enables us to examine and justify the research approach, aim, objectives and research questions. It discusses data collection and analysis, as well as the rationale for the choice of case study areas, thesis structure and potential contribution to knowledge.

4.2 Qualitative, quantitative and mixed-methods approaches in researching spatial data sharing

In exploring spatial data sharing, the first step for the researcher is deciding suitable methodological approaches for the research. In the general academic realm, methodological approaches can be categorised as qualitative, quantitative approach and mixed-method using both qualitative and quantitative approaches.

4.2.1 Qualitative approach versus quantitative approach in spatial data sharing research

A qualitative approach refers to understand the meaning, concepts, definitions, characteristics, metaphors, symbols and descriptions of the research object by exploring the what, how, when and where of an essence and character of the research object (Berg, 2001, pp.3). In contrast, a quantitative approach refers to measures and counts of variables and parameters that are relevant to the research object by creating indexes, scales or similar measurement indicators (Berg, 2001, pp.3). Both approaches have benefits and drawbacks: for example, in terms of researching spatial data sharing, a qualitative approach can examine the work of spatial data sharing system amongst institutions, but it cannot explain how many stakeholders should be involved to achieve optimal spatial data sharing implementations. In contrast, a quantitative approach can measure the optimal numbers of stakeholders in spatial data sharing context, but not all spatial data concepts are easy to measure.

4.2.2 Mixed-method approach in spatial data sharing research

Qualitative versus quantitative method debates over the benefits and rigor of each approach are still continuing (Tashakkori and Teddlie, 2003). Today, many scholars and researcher re-examine their research methods by utilising the strengths of qualitative and quantitative methods with the name of mixed-method approach (Creswell, 2003 and McDougall *et al*, 2007). A crucial point of a mixed-method approach is the way in which qualitative and quantitative methods are combined for a particular research object (Brannen, 1992). Bryman (1998) argues that there were three ways to combine the two strategies:

1. Predominance of quantitative over qualitative
2. Predominance of qualitative over quantitative
3. Qualitative and quantitative are given balance substance

However, Bryman (2007) warns that the mixed-method approach does not always solve social phenomena problem, circumspection should be used when integrating or interpreting phases of mixed method research.

4.2.3 Rationale selection to use qualitative approach in this thesis

Overall, no single methodology is perfect to examine spatial data sharing, but a qualitative approach is the most appropriate to examine the potential integration of official spatial data with crowd-sourced spatial data in spatial planning policy formulation at the very early stage of adoption in the Indonesian context. Qualitative method is also helpful for exploring the Indonesian government initiative from organisational, governmental, bureaucratic, policy and community participatory perspectives.

In the context of a case study, a qualitative approach can explain the natural meanings of individual and organisational life-worlds. Life-worlds may comprise emotions, motivations, symbols, and empathy (Berg, 2001). And by using a qualitative approach, the researcher can obtain in-depth understanding of the role of NSDI spatial data by accommodating crowd-sourced spatial data from VGI and its organisational spatial data management.

This research will explores the potentials for other things to happen, e.g. democracy, resulting from spatial data sharing through NSDI and VGI integration in spatial planning processes in Indonesia using archival research and in-depth interview with elites, other NSDI stakeholders and VGI communities. Each of the techniques will be explained respectively. The archival research consisted of collecting legal documents providing a background to the policy context in order to gain a comprehensive understanding of the NSDI and spatial planning formulation that has been conducted and will be conducted in the future. Interviews helped to understand the perspective of the government and planning stakeholders in terms of their current strategies and initiatives for promoting the NSDI in spatial planning processes from political, institutional and policy perspectives.

Using the data collected from document analysis and stakeholder interviews, the discussion of case studies of a new developmental approach to spatial planning will be created to understand the potential for NSDI and VGI collaboration in Indonesia.

4.3 Reasons for conducting a single case study

This research is not about how one country thinks about other countries in terms of assessing how structures are set up, which one is improving, and so forth. Rather, it is about gaining a fundamental comprehension of the circumstances at all government levels (*i.e.* central, province and local levels) in one country a system needs to work, and under which settings it can or cannot work. Only by creating standard measures that can be applied across all situations, national contexts and government structures can evaluations of comparative performance be made.

In helping to understand the particular circumstances of the effects of specific conditions on data sharing, this research can then be applied in other contextual analyses. The unit of study is not about how to contrast two or more countries, but about what constitutes and what impedes the spatial data transaction process. This can create theories which can be implemented later in different countries.

In addition, each country has a specific NSDI design context influenced by history, economics, legal structures, technology, culture, and institutional regulations (Rajabifard and Williamson, 2003a). Hence, in order to describe typical NSDI issues worldwide, studying an issue specific to one study area can give in-deepth understanding about NSDI, particularly the value of spatial data sharing and management. NSDI in developed and developing countries have been established at different time. As a comparison, GIS technology in developed countries has emerged since the 1960s, but in developing countries, GIS technology devices only emerged in the 1990s (Yeh, 1991). Therefore, taking this account, this thesis focuses on study in one country only – Indonesia - with detailed research at all administrative levels (national, province and municipality/regency). However, as already explained in Chapter 1, even though the research explores Indonesian circumstance, it resonates widely with other less wealthy nations. Therefore, the outcome of the study is generalisable in this respect.

4.4 Aim, objectives and research questions

4.4.1 Aim

This research aim to understand the links between spatial data sharing and democractic decision-making in Indonesian spatial planning by formulating new approaches of integration of official spatial data and crowd-sourced geographic information in spatial planning process. It highlights the processes and decisions made by the Indonesian government in order to operate the NSDI and it investigates the potential for integration with VGI in civil society in support of the spatial planning process.

4.4.2 Objectives

In order to achieve the aim, the objectives of this study are to:

- Investigate the role of spatial data in the Indonesian spatial planning process;
- Investigate the Indonesian central government efforts to achieve spatial data standardisation, strategic management, human resource capacity and organisational structures to be involved in NSDI operations;
- Examine the role of spatial data created by citizens;
- Investigate the readiness of province and local (municipality and regency) planning boards to adopt the NSDI system;
- Examine potential integration of SDI and VGI; and
- Suggest a potential SDI and VGI integration approach for enhancing democracy in spatial planning.

4.4.3 Research questions

Defining the research questions is probably the most crucial step to be taken in a research project. The research questions become the guidelines for the choice of research methods. Yin (2003) notes that research questions focused on “how” and “why” refer to the case studies, histories and experiments, because these questions deal with operational links that need tracing over a long time period than research focusing on the frequencies of events or incidence (Onatu, 2013). Yin

(2003) also notes questions focussing on “how” and “what” are generally used to obtain the stories of the research context.

The research objectives for this study can be formulated as six questions:

1. Why do spatial data and information have a significant role in Indonesian spatial planning process?

   This question will answer the importance of spatial data and information that are embedded in Indonesian national, provincial, municipal and regency spatial plans to bridge spatial development policy and state budget plan in urban and regional development implementations.

2. What processes has the central government of Indonesia used to develop NSDI?

   As mentioned in the Introduction, Indonesia has initiated the NSDI system to achieve an efficient government bureaucracy for spatial data dissemination. To answer this question, there is a need to explore mechanisms conducted by the central governments of Indonesia to adopt the NSDI system.

3. How is spatial data created by citizens used in Indonesia?”

   This question aims to explore the initiation and development of spatial data production and dissemination created by the citizen in Indonesia.

4. How is spatial data management performing at provincial and local government levels in supporting Indonesian NSDI?

   In line with One Map Policy (OMP), this question examines performance of management of spatial data at provincial and local government levels (i.e. municipality and regency) by assessing five pillars of NSDI: data, human resource, technology, organisation and policy.

5. How can SDI and VGI be integrated to meet top-down and bottom-up developmental approaches?

   This research question explores SDI and VGI issues through empirical studies. It examines the alternative proposed SDI and VGI integration framework and models to meet top-down and bottom-up developmental approaches between government and citizen in spatial planning application.

6. How can SDI and VGI integration enhance democracy in spatial planning?

   The answer to this question is the research contribution by developing a new approach to SDI and VGI integration in national spatial data management to achieve democracy in spatial planning from national to local administrative levels and *vice versa*.

4.5 Data collection and data analysis

This thesis is investigates the potential integration of authorised spatial data represented by NSDI with crowd-sourced geographic information represented by VGI in the formulation of the Indonesian statutory spatial planning system. Research respondents are key individuals who represent the primary custodians in government institutions and other line agencies with understanding of the NSDI, VGI and spatial planning context. The empirical studies take a qualitative approach in analysing the results of data collection from fieldwork observation, legal document analyses and in-depth interviews.

4.5.1 Research respondents

In terms of spatial data sharing, geography and planning scholars who use qualitative methods approaches examine values and beliefs relating to the "how", "why" and "what" of implementation of spatial data sharing. A small number of respondents who have a deep understanding of the fundamental areas were selected to explore their views on how spatial data sharing could enhance democracy in spatial planning. The method of selection used **non-probability sampling.**

A non-probability approach is more reasonable for grounded theory in which focus is frequently to comprehend complex social experience (Small 2009). As already explained in Chapter 1, spatial data sharing, particularly in the context of SDI and VGI integration, is still in theoretical development. Particular individuals or groups are selected for their understanding of the context. Therefore, this research used **purposive sampling** of recruited **expert respondents**.

That is, the researcher selects a sample of individuals they think would be suitable for the study. Purposive sampling is useful when there is a restricted number of individuals who have knowledge of the field being researched. In the case of this research respondents were selected based on their expertise and knowledge of spatial data sharing in spatial planning activities in Indonesia.

4.5.2 Interviews

Thirty three interviews were carried out with in middle and senior managerial roles in spatial data management supporting spatial planning in government institutions. They consisted of Indonesian government members in various administrative levels in central, province and municipality-regency government, geospatial professionals, a VGI expert and an academic. The fieldwork was conducted during the period of 7th January – 6th April 2015 in Jakarta, Makassar, Yogyakarta, Surabaya, Bojonegoro, Mataram and Gerung (See Figure 4.4). A list of the research respondents can be seen in Table 4.1.

Table 4.1 The List of Research Participants

No.	Organisation	Participant groups	Participant numbers
1	The BIG (Badan Informasi Geospasial) – The Indonesian National Geospatial Information Bureau	Central Government	7
2	BAPPENAS (*Badan Perencanaan dan Pembangunan Nasional)* – (The Indonesian National Development and Planning Agency)	Central Government	3
3	Indonesian Ministry of Agrarian and Spatial Planning	Central Government	1
4	Indonesian Ministry of Marine Affairs and Fisheries	Central Government	1
5	*Bappeda Provinsi* Jawa Timur (The Provincial of East Java Development and Planning Agency)	Provincial Regional Government	1
6	*Bappeda Provinsi* Nusa Tenggara Barat (The Provincial of West Nusa Tenggara Development and Planning Agency)	Provincial Regional Government	1
7	*Dinas komunikasi, informasi dan telekomunikasi provinsi* Jawa Timur (The Provincial of East Java telecommunication, information and communication agency)	Provincial Regional Government	1
8	*Dinas komunikasi, informasi dan telekomunikasi provinsi* Nusa Tenggara Barat (The Provincial of West Nusa Tenggara	Provincial Regional Government	3

	telecommunication, information and communication agency)		
9	*Bappeda Kota* Surabaya (Surabaya Municipal Development and Planning Agency)	Municipality Local Government	2
10	*Bappeda Kota* Mataram (Mataram Municipal Development and Planning Agency)	Municipality Local Government	1
11	*Dinas komunikasi, informasi dan telekomunikasi kota Surabaya* (Surabaya Municipal telecommunication, information and communication agency)	Municipality Local Government	1
12	*Dinas komunikasi, informasi dan telekomunikasi kota Mataram* (Mataram Municipal telecommunication, information and communication agency)	Municipality Local Government	1
13	*Bappeda kabupaten* Bojonegoro (Bojonegoro Regency Development and Planning Agency)	Regency Local Government	2
14	*Bappeda kabupaten* Lombok Barat (West Lombok Regency Development and Planning Agency)	Regency Local Government	1
15	*Dinas komunikasi, informasi dan telekomunikasi kabupaten Bojonegoro* (Bojonegoro Regency telecommunication, information and communication agency)	Regency Local Government	1
16	*Dinas komunikasi, informasi dan telekomunikasi kabupaten Lombok Barat* (West Lombok Rgency	Regency Local Government	1

	telecommunication, information and communication agency)		
17	Environmental Systems Research Institute (ESRI) Indonesia	GIS Software provider and Indonesian clearinghouse developer	3
18	Humanitarian OpenStreetMap Team (HOT) Indonesia	VGI expert	1
19	Department of Geomatics – Gadjah Mada University	Academic	1
	Total		33

The selected interviewees were contacted through emails or phone calls an accordance with research ethics, at the start of each interview, the interview consent was obtained before any recording took place. In order for ensure confidentiality for the interviewees due to the sensitive nature of some of the issues, the interviewees' names and positions were made anonymous.

The in-depth interviews were undertaken by brainstorming between the interviewees and researcher to become an acquainted with spatial data sharing practices in the spatial planning process. In this case, the respondents explained their current working activities and experiences in using GIS and also their ideas of the potentials and difficulties of spatial data sharing amongst institutions. In order to facilitate the process and to ensure all information was collected all interviews were recorded with digital voice recording and then later transcribed. Analysis of interview information classified the material according to the key beliefs underlying the research domain/coding.

Even though this thesis has interviewed experts who have spatial data sharing and spatial planning experiences, there were some potential interviewees unwilling to participate, they were official agencies who have occupied the highest management staff in government agencies, such as ministries and head of national geospatial information agency. To mitigate this situation, the researcher decided to ask the official internal reports of ministries and national mapping agency to their staff in supporting the thesis arguments. Furthermore, analysis of official internal reports will include to the archival research that will be discussed in the next section.

4.5.3 Archival Research

Archival research of legal documents had the purpose of providing a basic background of the policy context to gain a comprehensive understanding of the NSDI and the spatial planning policy formulation that has been conducted in the past and likely to be conducted in the future.

The primary documents used as the principal references for this study are as follows:

1. Geospatial Information Act No.4/2011
2. Presidential Decree No. 85/2007 of the National Spatial Data Network
3. Presidential Decree No.27/2014 of the amendment National Spatial Data Network
4. Governmental Regulation No.9/2014 of Detailed Geopsatial Information Act No.4/2011 implementation
5. Governmental Regulation No.8/2013 of Spatial Planning Map Guides
6. The Indonesian National Spatial Data Infrastructure Guidelines
7. The Indonesian NSDI Clearinghouse Guidelines
8. The Indonesian NSDI Custodian Guidelines
9. Spatial Planning Act No.24/1992
10. Spatial Planning Act No.26/2007
11. Governmental Regulation No.15/2010 of Spatial Planning Act Practices
12. Relevant reports prepared by government institutions pertaining to the implementation of the NSDI and Spatial Planning policy formulation.
13. National Development and Planning System Law No.25/2004
14. Law No.17/2007 of Indonesian Long-term Development Plan 2005-2025

Some of these legal documents have been collected by downloading from the official Indonesian government websites. Other relevant documents that cannot be directly accessed, such as the internal reports relevant to the NSDI and spatial planning process, were obtained by writing a formal request letter to the relevant agencies. All documents were downloaded and/or scanned and then stored on a laptop, an external hard disk and cloud storage as a backup.

4.5.4 Coding and content analysis

Identifying keywords relating to spatial data sharing issues was conducted by a method of coding of data and information collected through fieldwork. Coding can be depicted as data interpretation and incorporates the naming of ideas and clarifying and examining them in detail. The clarifications are reflected in coding memos. The consequence of coding is then a rundown of terms and also an informative guide to content (Böhm, 2004). In the data, indicators of the social phenomena being studied are looked for. The objective of the primary examination of the findings is the generation of codes that relate specifically to the data (Glaser and Strauss, 1967). Three classes of coding can be recognised as research stages, viz. open, axial and selective coding (Strauss and Corbin, 1990).

The first step taken in coding information from this research is ***open coding***. The researcher selected keywords as fundamental factors for spatial data sharing implementation in four categories: (1) spatial data sharing issues at central government level; (2) spatial data sharing issues at provincial government level; (3) spatial data sharing issues at municipal / regency government level; (4) spatial data sharing between VGI communities through OSM. The second step of the coding process is ***axial coding***. Information obtained on the open coding is further classified into similar themes or categories. The last step is ***selective coding***. The researcher integrated the coded information into new classifications as a guide in building the framework. A data collection and data analysis activity flow chart for this research is shown in 4.2.

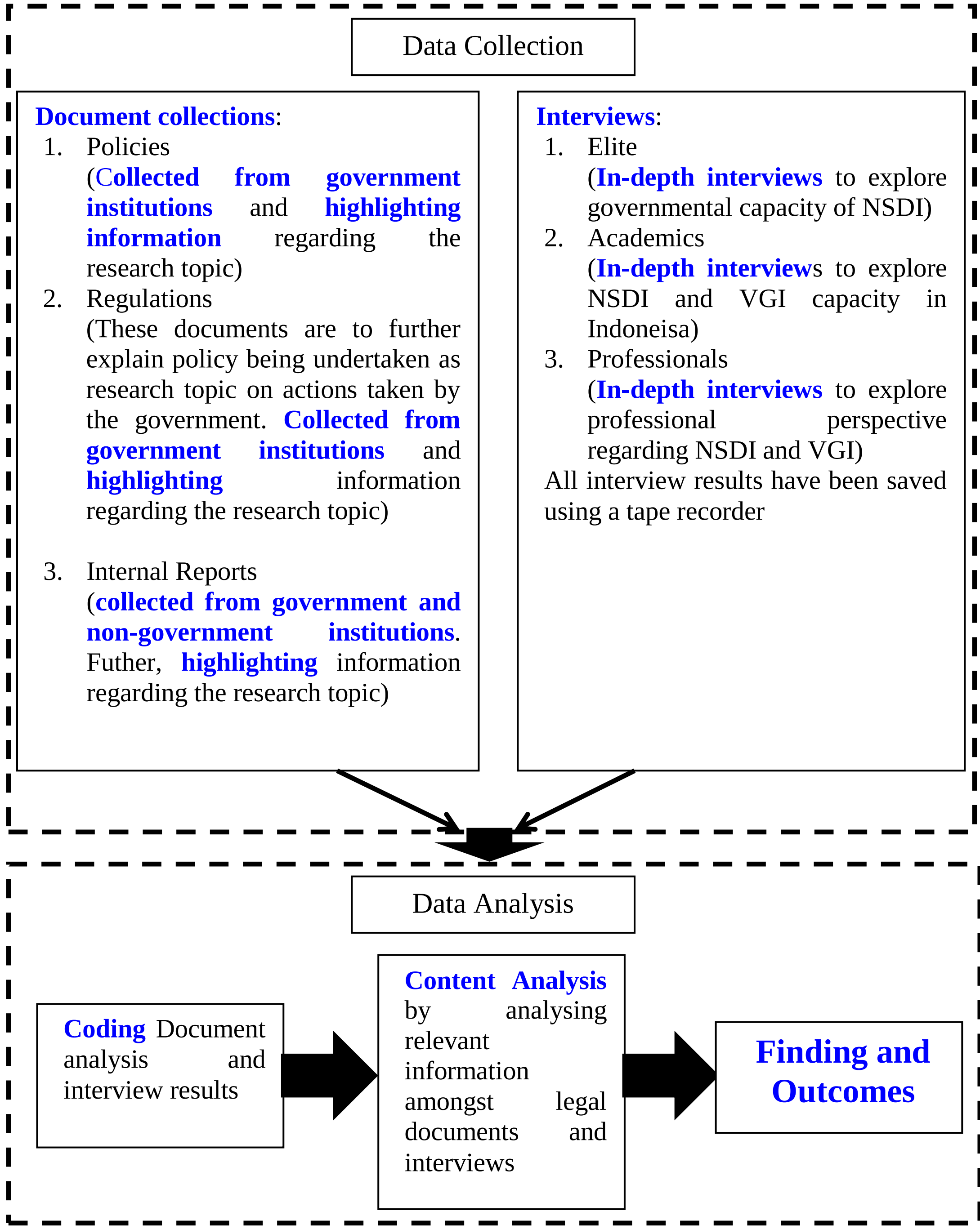


Figure 4.1 Data Collection and Data Analysis Activity Flow Chart

4.6 Selection of case studies: central, provincial, municipal and regency government levels.

The best optimal analysis of NSDI implementation can be carried out if the study area coverage is undertaken at all government levels. In this context, the case study area compares spatial planning systems at national, province, municipality and regency levels. The selection of case studies follows the hierarchy of government levels by involving the central, province, municipality and regency government levels.

The case study of the central government level is located in Jakarta as the capital city of Indonesia (See Figure 4.5). The research was conducted in Ministries/state agencies associated with spatial planning policy formulation, viz., the Ministry of Agrarian and Spatial Planning, the Ministry of National Development Planning, the Ministry of Marine Affairs and Fisheries, and the National Geospatial Information Agency (BIG). The reason for selecting these agencies is that these government institutions directly deal with the spatial data and information procurement, management and utilization.

The study of spatial data management at the central government level was conducted with the purpose of identifying spatial data usage and examining spatial data development and sharing by work units in each government institution that interacts directly with spatial data usage for spatial planning activities.

In understanding spatial data sharing issues in Indonesia, aside from conducting the research at all government levels (national, province, municipality and regency), the research was also conducted based on the Indonesian geo-political sets targets and performance goals that rank different governance performance. The distribution of the Indonesian geo-politcal government groups in the category of more developed and less developed governance performance levels.

The aim of distinguishing between governance performance levels in the case study research was to refine the understanding gained of government capabilities for developing, building, operating/modifying and maintaining spatial data infrastructure to support the spatial planning agenda in their governance authority areas. In order to consider these issues there was a need to identify groups of more developed and less developed governance performance levels.

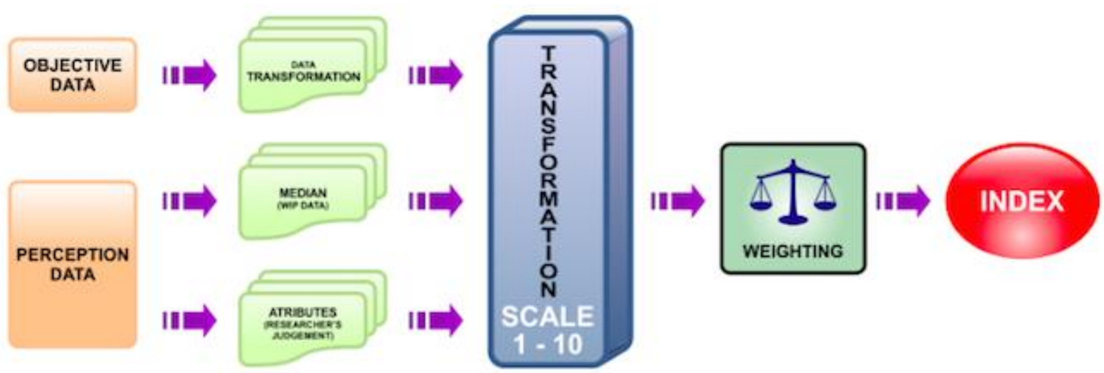
The Indonesian Governance Index (IGI) has published by the "Kemitraan", a national NGO established with the cooperation of government agencies to promote reform of the bureaucracy at local, regional and national levels. During conducting the research, the IGI published all provincial government capabilities assessment (including the provincial councils and the provincial housing representatives. Detailed of government capabilities assessment indicators can be seen in Appendix A), bureaucratic mechanisms, civil society engagement and economic and social development (Kemitraan, 2012). Meanwhile, for municipality and regency governance performance assessment still in assessment progress until this research finished. Therefore, the selection of municipality and regency as case studies were selected based on of the historical spatial data infrastructure development initiative from *Badan Informasi Geospasial* (BIG)'s reports.

The IGI assessment methodology used by Kemitraan (2012) can be described in the following sequence: firstly, by determining the indicator based on:

(a) significance;
(b) relevance to regional and local authority;
(c) data availability;
(d) discriminating power; and
(e) communality across regional and local context.

(See Appendix A for details of the IGI)

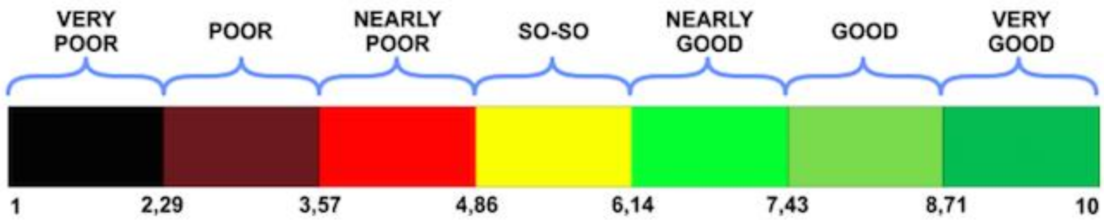
Secondly, Kemitraan researchers determined the weight of area in each indicator using an Analytical Hierarchy Process (AHP). The next step was an indexing process shown in Figure 4.3.



(Source: http://www.kemitraan.or.id/igi/index.php/framework/methodology access on 9th Septermber 2014 at 4.03 pm)

Figure 4.2 Indexing Indonesian Government Process

The last step was determining the Index scale. Kemitraan (2012) divided the 1-10 scale of governance index into 7 groups. The detailed illustration can be seen in Figure 4.4.



(Source: http://www.kemitraan.or.id/igi/index.php/framework/methodology access on 9th Septermber 2014 at 4.09 pm)

Figure 4.3 The IGI Index Scale

IGI assessment has been conducted for the provincial government performance in 2012 (See Table 4.2), and the assessment for the local government performance status that comprises of Municipality (Kota) and Regency (Kabupaten) is still on going process (Kemitraan, 2012).

Table 4.2 IGI Province Performance

Ranks	Year	Province	Index
1	2012	Yogyakarta	6.80
2	2012	East Java	6.43
3	2012	DKI Jakarta	6.37
4	2012	Jambi	6.24
5	2012	Bali	6.23
6	2012	South Sumatera	6.19
7	2012	South Kalimantan	6.19
8	2012	Riau	6.18
9	2012	North Sulawesi	6.17
10	2012	Lampung	6.01
11	2012	Bangka Belitung Islands	5.97
12	2012	Centrak Kalimantan	5.95
13	2012	North Sumatera	5.94
14	2012	West Sulawesi	5.91
15	2012	West Java	5.88

16	2012	Central Java	5.88
17	2012	Banten	5.85
18	2012	Aceh	5.82
19	2012	West Nusa Tenggara	5.74
20	2012	West Sumatera	5.70
21	2012	South Sulawesi	5.67
22	2012	East Kalimantan	5.66
23	2012	Gorontalo	5.64
24	2012	Riau Islands	5.60
25	2012	Central Sulawesi	5.47
26	2012	West Kalimantan	5.11
27	2012	South East Sulawesi	5.05
28	2012	Maluku	4.95
29	2012	Papua	4.88
30	2012	East Nusa Tenggara	4.87
31	2012	Bengkulu	4.81
32	2012	West Papua	4.48
33	2012	North Maluku	4.45

Notes: The 34th Province, namely North Kalimantan Province was created in 2013, thus the province was not assessed.

(Source : http://www.kemitraan.or.id/igi/index.php/province-performance access on 9th September 2015 at 4.41 pm)

Drawing on the IGI performance index, all areas has been grouped by Kemitraan in three categories, namely

(1) range 6.14 – <7.43 = nearly good;

(2) range 4.86 - <6.14 = so-so;

(3) 3.57 - < 4.86 = nearly poor.

For this thesis, the researcher has identified all areas involved in **the 'nearly good'** group as **a 'more developed region'** class; all areas involved in **the 'so-so'** group as **a 'less developed region'** class; and all areas involved in **the 'nearly poor'** group as **an 'undeveloped region'** class. Generally, the IGI performance index created by Kemitraan was a useful method for selecting particular research areas for this study, even though it is still raising debates in assessment. This is because the assessment indicators were not an international consensus but, a local ranking. The more developed group has an index value above 6.14 on the IGI Index scale and it is assumed that the foundation for preparing technological aspect, in this case is a spatial data database infrastructure, has been created since GIS was adopted in Indonesia in the 1990s. The less developed group has an index value in the range of 4.86 up to 6.14 on the IGI Index scale, and it is assumed that the area has a foundation for preparing spatial data infrastructure since GIS was adopted in Indonesia during the 1990s.

Finally, the undeveloped region group has an index value of less than 4.86 on the IGI index and it is assumed that there is no foundation for preparing spatial data infrastructure. Furthermore, the undeveloped governance capacity group lacked spatial data management knowledge, and there were limited documents and reports relevant to NSDI and few knowledgeable respondents, meant that it was likely there would be little or no information gained from fieldwork in these areas. Hence, the researcher decided to conduct the study in two groups only for comparison, namely the more developed regions and less developed regions.

According to the selection process for case study areas outlined above and supporting official documents from Indonesian mapping agency , BIG, for the more developed province, The Province of East Java was selected (See Figure 4.4 for the location), which has an index value of IGI 6.43 (ranked 2 out of 33 provinces which were assessed) and The Province of West Nusa Tenggara was selected for the less developed province (See Figure 4.4), which has an index value of IGI 5.74 (ranked 19 from 33 provinces) (see Table 4.2). The municipality areas were chosen based on the provincial capital city with historical GIS and SDI development based on BIG’s reports in the selected provinces, in which the selected more developed municipality was Surabaya municipality (See Figure 4.4), while the selected less developed municipality was Mataram municipality (See Figure 4.4).

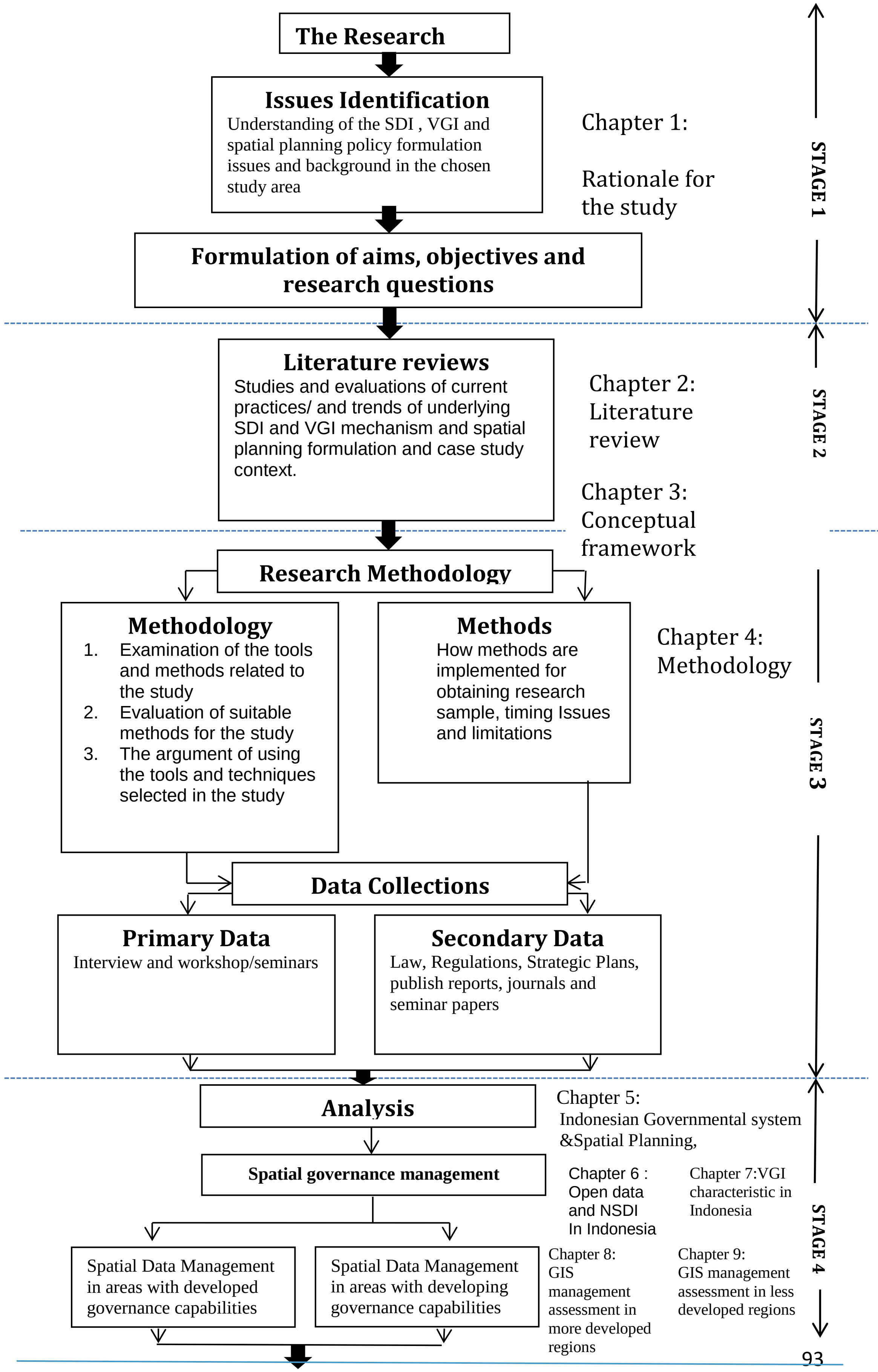
Finally, the selection of regency areas was based on reports published by BIG in terms of the historical GIS and SDI development in Indonesia. Bojonegoro regency was selected for the more developed regency, because the area has been chosen by BIG as a national pilot project of SDI for regency level in 2013 (See Figure 4.5), while, West Lombok regency was selected for the less developed regency (See Figure 4.4). The selection based on the historical of GIS initiation in Indonesia in 1990s that the regency was one of the national pilot projects for GIS adoption in the government working environments.

Source: Cretaed by Author from ESRI Library Database, 2016

Figure 4.4 The Case Study Areas

4.7 Research flow and thesis structure organisation

Generally, this research aims to discover a new approach to enhancing democratic spatial planning through creating better NSDI operated by the Indonesian governments whilst investigating potential integration with VGI. This section will presents the research flowchart which indicates the research framework. The research flowchart aims to summarise the conceptual theories and methodological frameworks discussed in chapter 2 and 3.


The Research
Issues Identification
Understanding of the SDI , VGI and spatial planning policy formulation issues and background in the chosen study area
Chapter 1:
Rationale for the study
STAGE 1
Formulation of aims, objectives and research questions
Literature reviews
Studies and evaluations of current practices/ and trends of underlying SDI and VGI mechanism and spatial planning formulation and case study context.
Chapter 2: Literature review
STAGE 2
Chapter 3: Conceptual framework
Research Methodology
Methodology
1. Examination of the tools and methods related to the study
2. Evaluation of suitable methods for the study
3. The argument of using the tools and techniques selected in the study
Methods
How methods are implemented for obtaining research sample, timing Issues and limitations
Chapter 4: Methodology
STAGE 3
Data Collections
Primary Data
Interview and workshop/seminars
Secondary Data
Law, Regulations, Strategic Plans, publish reports, journals and seminar papers
Analysis
Chapter 5: Indonesian Governmental system &Spatial Planning,
Spatial governance management
Chapter 6 : Open data and NSDI In Indonesia
Chapter 7:VGI characteristic in Indonesia
Spatial Data Management in areas with developed governance capabilities
Spatial Data Management in areas with developing governance capabilities
Chapter 8: GIS management assessment in more developed regions
Chapter 9: GIS management assessment in less developed regions
STAGE 4

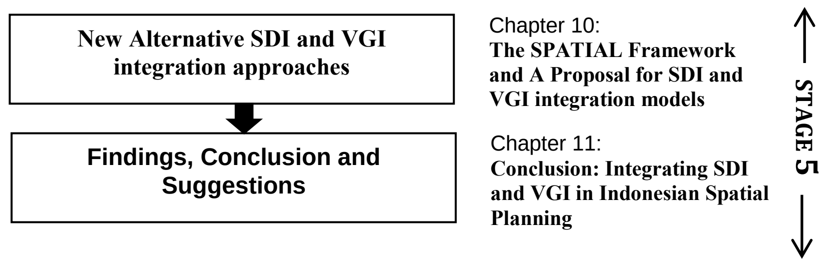


Figure 4.5 Research Flowchart and Thesis Structure

Figure 4.6 shows that the first stage of this research was finding an appropriate topic for PhD level research by observing planning phenomena from the global to the micro scale and identifying specific local spatial planning issues. From this, the research aim, objectives and questions were formulated.

The working experiences of the researcher as a geospatial professional who worked in spatial analysis to support spatial planning policies in Indonesia for five years has acknowledged the lack of spatial data provision and less coordination of spatial planning in Indonesia. Within this consideration, the researcher encourages himself to conduct this research through PhD programme to find out solutions. This thesis provides a systematic way to the process, addressing issues and proposing a framework and models relevant to spatial data sharing in enhancing spatial information to create seamless and coherence spatial planning between different government levels (national to sub-national levels) and equal government levels (e.g. amongst adjacent administrative locations). Ultimately, this PhD thesis could be expected to produce better knowledge of spatial data sharing and lead to better spatial planning practice in developing countries generally and Indonesia specifically.

In terms of gaining insight into NSDI in Indonesia by investigating potential integration with VGI in support of the spatial planning process, the first thing to be explored was the background contextual information about the Indonesian Planning System. The context may drive readers to highlight the role of spatial data and information in the Indonesian spatial planning process. These considerations will be described in the next chapter.

CHAPTER 5

THE INDONESIAN GOVERNMENT SYSTEM, SPATIAL POLICY AND PUBLIC PARTICIPATION

5.1 Introduction

This chapter examines the current Indonesian government system, spatial policy and public participation. The investigation aims to understand the performance and procedures of government agencies in carrying out planning and development as well understanding the characteristics of the communities participating in the planning and development agenda formulated by the Indonesian government. In addition, these investigations aim to answer the first research question: Why do spatial data and information have a significant role in Indonesian spatial planning process?

The basic structure of the chapter is divided into four main sections. The first section provides an overview of the Indonesian government system in carrying out the planning and development agenda from central to local government levels. The second section explores Indonesian spatial policy describing Indonesian spatial planning procedures at central, province and municipality also regency government levels. The third section examines synchronizing the Indonesian development plan with the spatial plan; and the final section examines public participation in Indonesian spatial planning to suggest how democracy in spatial governance context can be achieved in Indonesia through spatial data and information sharing in support of spatial planning policy.

5.2 An Overview of the Indonesian System of Government

The aim of this section is to provide a broad overview of the Indonesian government system giving the institutional and historical context in which the government authorities operate. The general description of the Indonesian government system in this section describes the form of state and government structures in order to understand how the Indonesian government carries out planning and development agenda comprehensively.

5.2.1 The Form of the Indonesian State and Government

The form of the Indonesian state is enshrined in the Indonesian Constitution 1945, called *Undang-Undang Dasar 1945* (UUD 1945). The Indonesian Constitution set forth Indonesia as a unitary state (GoI, 1945). As a unitary state, Indonesia adheres to a 'triad structure', which divides government power into three areas – the legislature, the executive and the judiciary - which have a parallel positions.

1. The Legislature is in charge of making laws. The legislative institution are the People's Consultative Assembly (MPR) and the Indonesian House of Representatives (DPR).
2. The Executive is in charge of applying or implementing the law. The executive institution is the President and Vice President and the Ministers assisting the President, that is, a cabinet style of government
3. The Judiciary is tasked with defending the implementation of the legislation. The judiciary consists of the Supreme Court (MA) and the Constitutional Court (MK).

The Indonesian government system is a combination of a Presidential system and a Parliamentary system with the following characteristics:

1. The legislative power has the dominant role regarding policy and regulation enactment;
2. The President may not disband the House of Representatives;

3. The people directly elect the President and Vice President;
4. The People's Consultative Assembly (MPR) does not act as the highest institution. The MPR members consist of all DPR plus the Indonesian Regional Representative Council (DPD) members elected directly by the people.

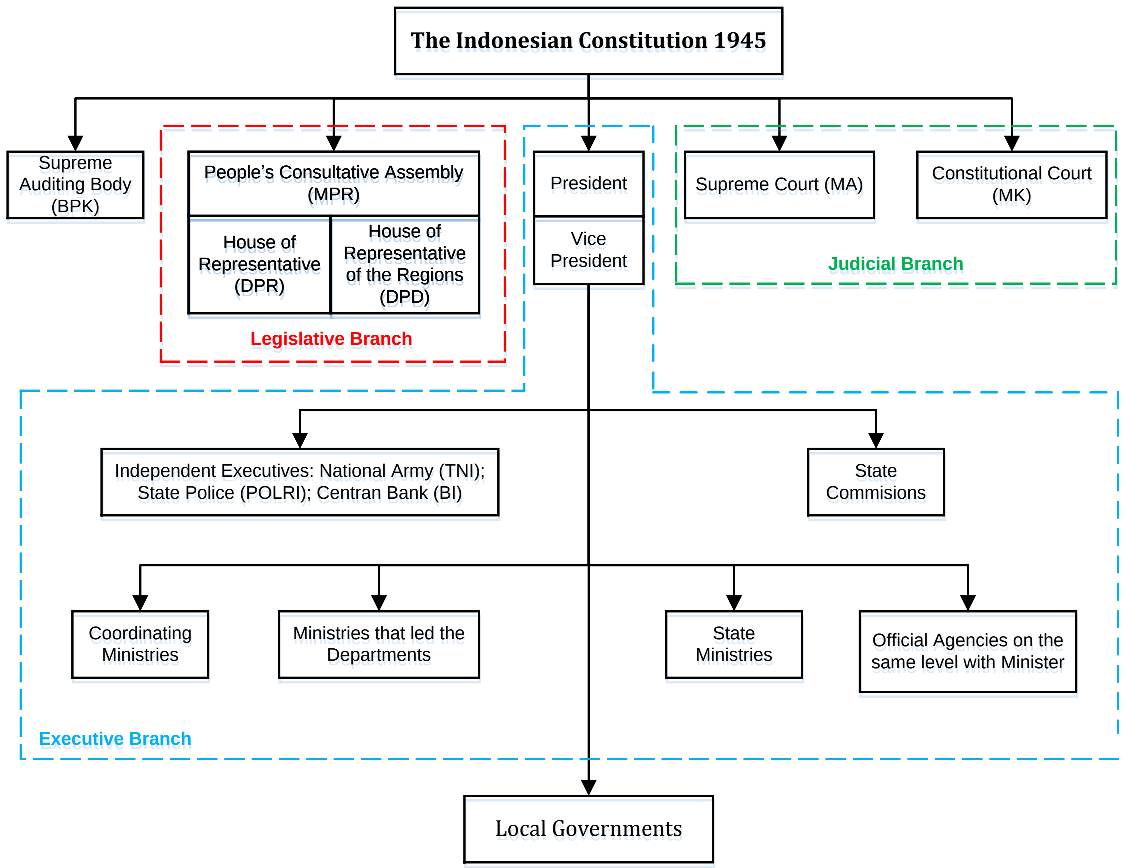
The Indonesian government structure period since 1998 has been liable to various decentralisation transformations. The particular impact of decentralisation is that the power of local level government, municipality and regency, has increased so that is equal with provincial government level.

Before 1998 all province and local government authority arrangements had to be affirmed by central government before they were made. But subsequent to 1998, all province and local government authorities gained the ability to make agreements that were then subject to the control of law after the agreement ratified by central government.

In these arrangements, the planning and development phases of the planning process require negotiations between the national Executive, which is responsible for conducting planning and development and the Legislature as a state agency in charge of enacting legal policies. To understand the institutional relations of the state agencies in the Indonesian planning and development process, the next section discusses the government structure at the central level and the executive agencies structure from the central to local level.

5.2.2 Indonesian government structure and spatial planning from central to local levels

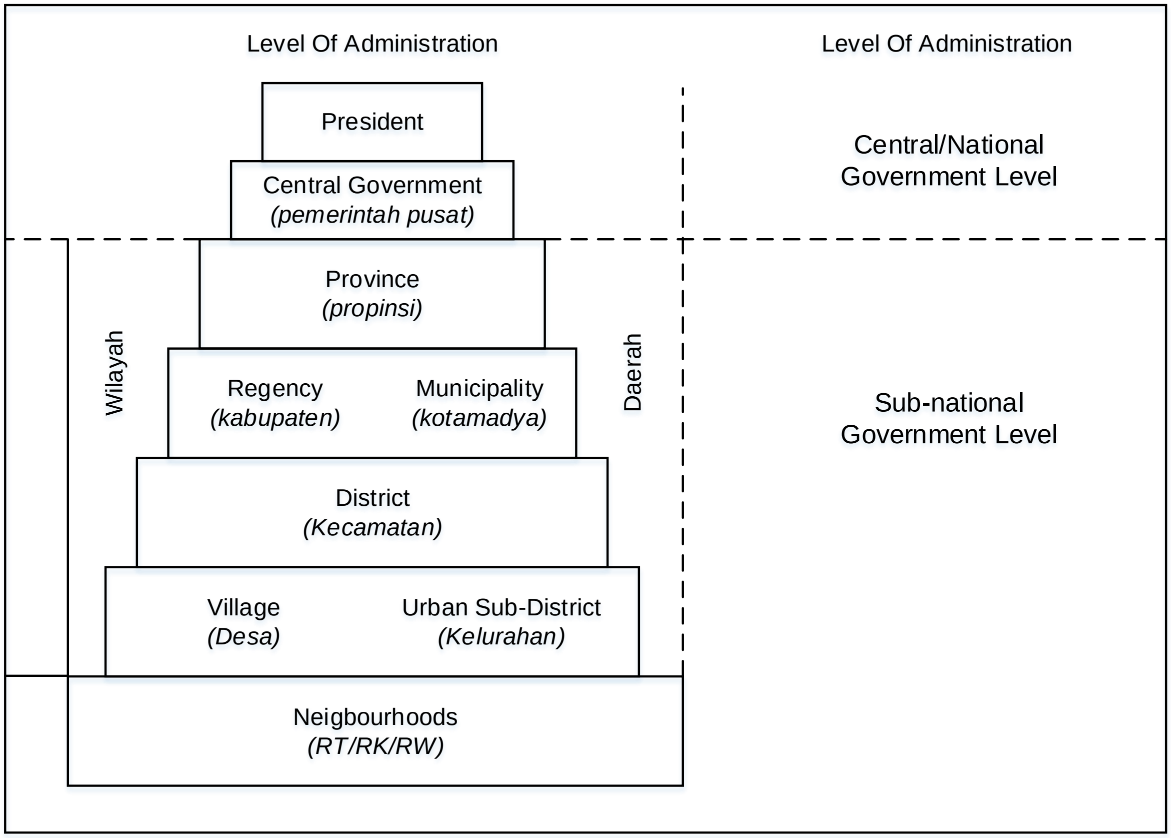
The Indonesian Constitution of 1945, amended in 2002, distributes authority equally between (all) state institutions. This position can be explained as follows: The People's Consultative Assembly (MPR) consists of the House of Representatives (DPR) and the House of Representatives of the Regions (DPD) as the institutions of legislative government; the President, Vice President, independent executives, state commissions and Ministries are agents of executive government; the Supreme Court (MA) and the Constitutional Court (MK) are the institutons of judiciary government; and finally, the Supreme Auditing Body (BPK) is the independent auditing agency (see Figure 5.1).



Source: Created by the Author by modification from Prasojo et al., 2007, pp. 31

Figure. 5.1. The Structure of Indonesian National Government

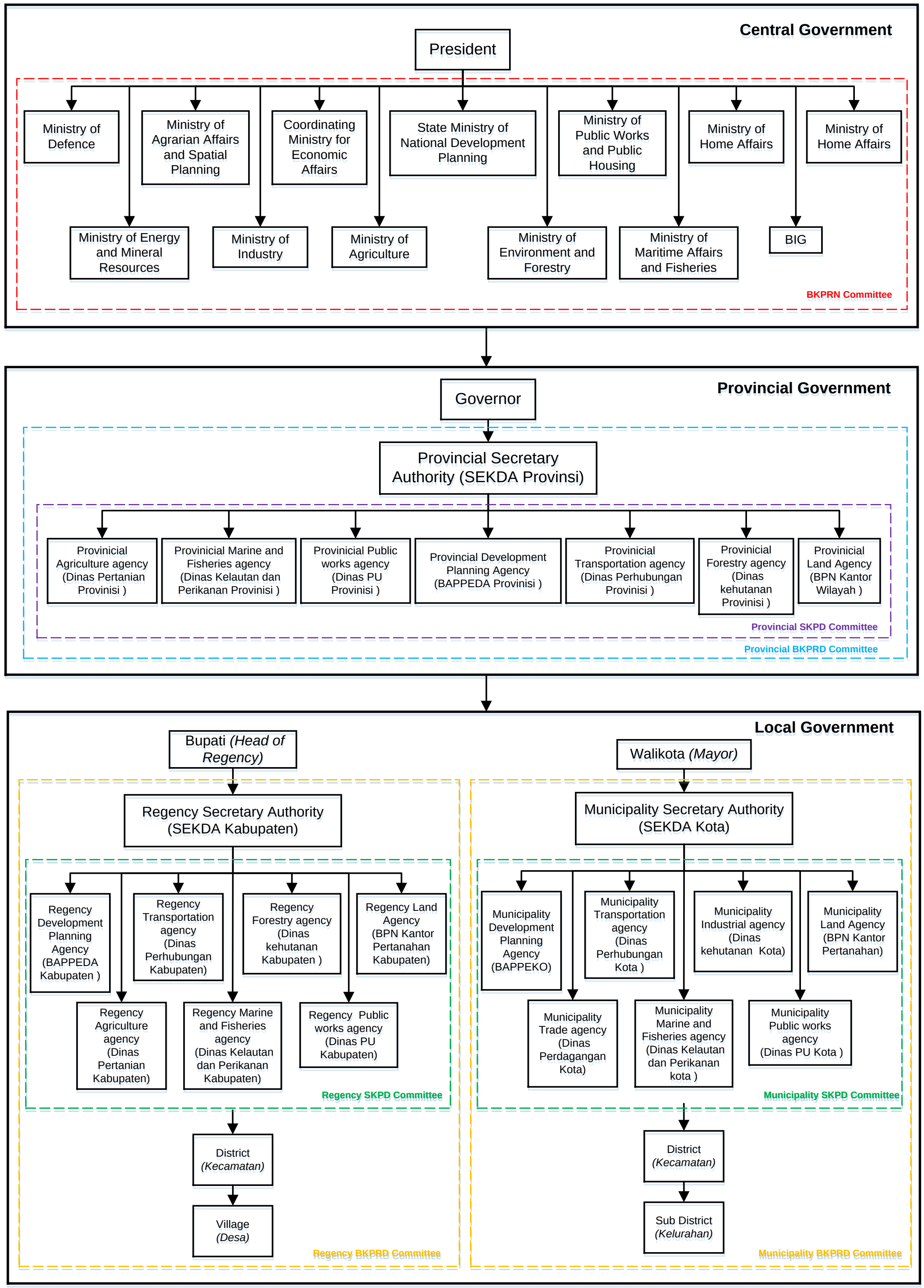
This section gives an overview of administrative arrangements at central, province and municipality/regency levels. At the local level, government institutions are the municipality, regency, *kecamatan*, *kelurahan* and *desa* administrations (See Figure 5.2).



Source: Wrihatnolo (2009), pp. 44 in http://www.slideshare.net/wrihatnolo/mekanisme-perencanaan-pembangunan-daerah

Figure 5.2 Level of Government Administration in Indonesia

Every province has its own capital city and is headed by a Governor. The province consists of the municipality governments and the regency governments. Every municipality and regency is headed by a *Walikota* (Mayor) or a *Bupati* (Head of the Regency) respectively. These municipalities and regencies consist of several district areas or the *Kecamatan* headed by a *Camat* (Head of the Sub-District). The lowest level of government is the *Kelurahan* (the Urban Sub-District) and the *Desa* (the Villages), which headed by a *Lurah* (Head of the Urban Sub-District) and a *Kepala Desa* (Head of the Village) respectively. The relationship government agencies from central to local government levels can be seen in Figure 5.3



Source: Created by Author in 2016

Figure 5.3 The Structure of Indonesian Government from Central to Local Levels

Spatial planning is considered to be a holistic activity (The Indonesian Law No.26 of 2007), thus it requires collaboration amongst sectoral Ministries and government agencies during formulation, operationalisation and evaluation of planning phases. To achieve a consensus in the planning process, The Indonesian government institutions having tasks relevant to spatial planning activities are incorporated under an *ad hoc* team, called The Spatial Planning Coordinating Board, *Badan Koordinasi Penataan Ruang* (BKPR). The BKPR is divided into national, provincial and regency/municipality levels.

The National Spatial Planning Coordinating Board (BKPRN) was established in response to the needs of various government agencies in dealing with various development and planning agendas under one national planning board coordination (GoI, 2009a). In accordance with Presidential Decree No. 4 of 2009, BKPRN consists of 14 Ministries/ National agencies with tasks including the following: coordinating negotiation amongst planning stakeholders arising from conflict in spatial planning implementation, and providing guidance and advice to solve problems; harmonizing legislation related to the spatial planning implementation; synchronization of general plans and detailed spatial plans with the legislation, including the National Spatial Plan and detailed plans; and coordinating efforts to increase the institutional capacity of central government and local government in spatial planning implementation.

At the provincial level, there is a Governor who is in charge of all the planning and development at the provincial level. He/she is assisted by an *ad hoc* spatial planning provincial level agency, called *Badan Koordinasi Perencanaan Ruang Daerah Provinsi* (BKPRD Provinsi). The legal basis for the establishment of BKPRD is the Ministry of Home Affairs Regulation No. 50/2009. It is assisted by *Satuan Kerja Perangkat Daerah Provinsi* (SKPD Provinsi) - an *ad hoc* institution in the form of a set of government services pertaining to spatial planning at the province level such as public works, transportation, marine and fisheries, forestry, energy and mining, agriculture, and industry services. The establishment BKPRD Provinsi ensures that the implementation of the spatial planning agenda is coherent at all levels, while also dealing with spatial planning issues related to the conflicts between planning issues.

Finally, the *bupati* at the regency level and the mayor at the municipality level are in charge of all the local planning and development. Both leaders coordinate the development and planning of the regency / municipality through *Badan Perencana Pembangunan Daerah* kabupaten/kota (Bappeda kabupaten/kota) – an Regional body for planning and development. It is assisted by *Satuan Kerja Perangkat Daerah Kabupaten/Kota* (SKPD kabupaten/kota) - an *ad hoc* institution in the form of a set of government services pertaining to spatial planning at the regency and municipality levels, such as public works, transportation, marine and fisheries, forestry, energy and mining, agriculture, and industry services.

5.3 The Indonesian Spatial Planning Policies

In general, the comprehensive planning policies in Indonesia is divided into three parts: the Development Plan, the Spatial Plan, and the State Budget Allocation Plan. In practice, the three systems are related and complement urban and regional development and planning.

1. The Development Plan

The Development Plan is a translation of the values contained in the Constitution, and ratified in Law No. 25 of 2004 on National Development Planning System (SPPN). SPPN is a replacement of the outlines of state policy, *Garis-garis Besar Haluan Negara* (GBHN) as a result of the Indonesian Constitutional 1945 amendments. SPPN is the implementation of Indonesia's development direction for the long-term development period of 20 years, known as the National Long-Term Plan (RPJPN). This development period is divided into five-year durations known as Medium-Term Development Plans (RPJMN). Finally, the detailed RPJMN is the government’s annual implementation plan refered to as the Government Work Plan (RKP) at the province, regency and municipality levels.

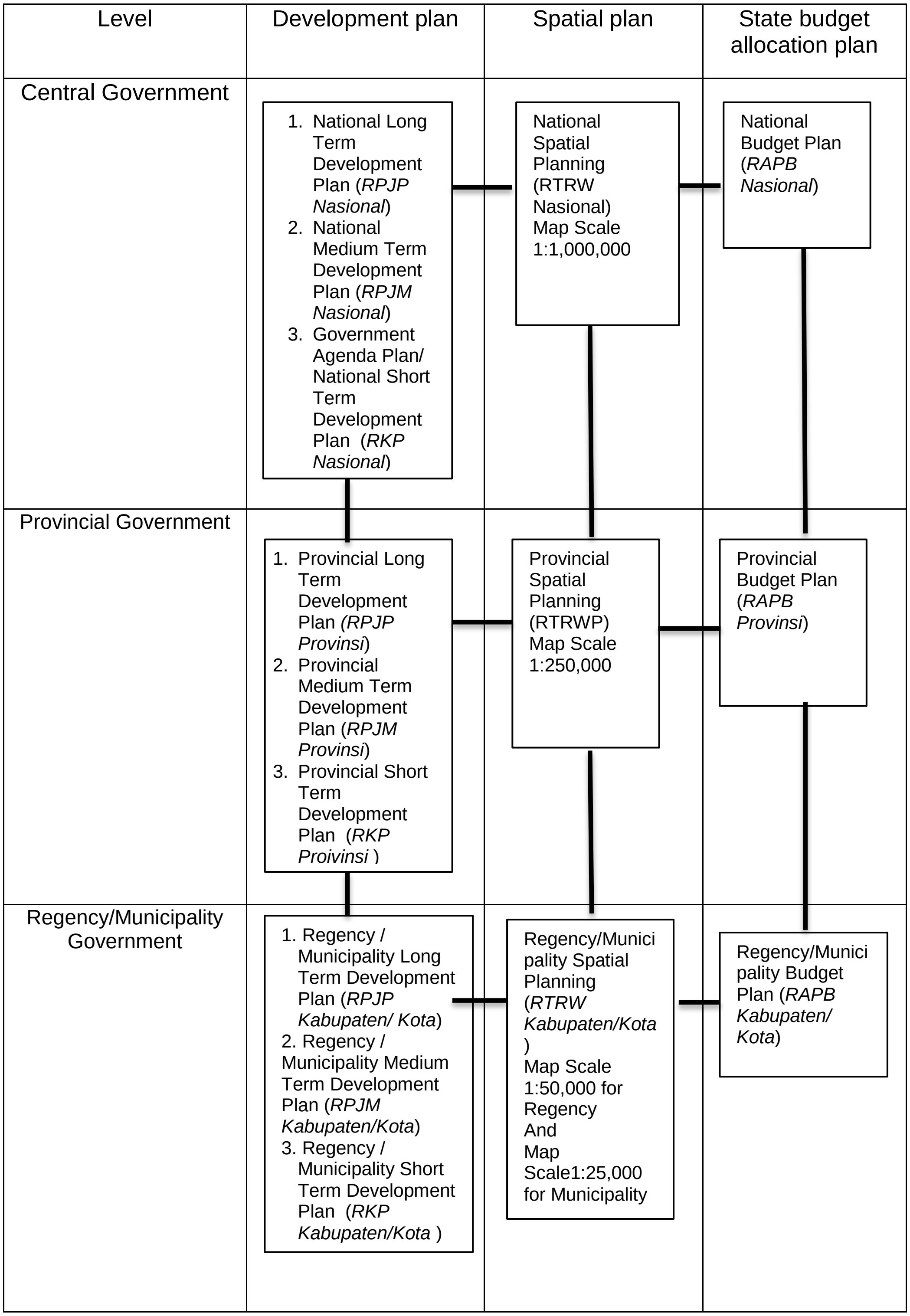
2. The Spatial Plan

The spatial plan is a guideline for the optimal harmonious utilisation of natural resources, as well as the basis for the country's development priorities in guiding the development of infrastructure and shaping the spatial structure and land use plan. The spatial structure plan relates to the public service networks connected by the infrastructure networks system between different governmental administrative areas (national strategic sites, provinces, regencies and municipalities). The land use plan is concerned with environmental protection and built environment areas. Within this consideration, spatial data and information have a significant role in providing spatial structure and utilisation visualization. The Indonesian spatial plan is stipulated in the Law. No. 26 in 2007 and categorised in a hierarchical system at national, province, regency and municipality levels.

3. The State Budget Allocation Plan

The implementation of the development plan translated into the spatial plan depends on the state budget allocation that is approved and distributed by the central, province and local government levels. The budget for the operationalization of development and planning is known as the National / Sub-national (*i.e.* province, municipality and regency levels) State Budget (APBN / APBD). The State Budget Allocation Plan stipulated in Law No.17 / 2003 of State Budget at each government level.

The relationship between the Development Plan, the Spatial Plan and the State Budget Allocation Plan can be seen in Figure 5.4.



Source: Created by Author in 2016

Figure 5.4 The Relationship Between The Development Plan, The Spatial Plan and The State Budget Allocation Plan

The Table shows that the use of spatial data and information is crucial for translating the "language of RPJPN and RPJMN" into the context of development that is tailored to a geographic region. Spatial data and information contained in the spatial plan will identify priorities in determining the amount of the budget to be approved.

From three Indonesian development and planning aspects, very relevant to the focus of this research on spatial data and information usage concerns on the Development Plan and the Spatial Plan. Thus, this section will focus on both plans.

The next section discusses in more detail procedures for the operationalisation of the Development Plan and the Spatial Plan.

5.3.1 The Indonesian Development Plan

The Indonesian development plan commenced a new phase in 2005, with the renewed Indonesian developmental vision, marked by fundamental changes in the Indonesian political and governmental system. During 1998-2004 periods, the Indonesian government had commenced the government transition which transformed the Indonesian government system from centralistic to decentralisation system. In this period, many laws and regulations were enacted and the Indonesian Constitution 1945 was amended four times. One of the fundamental transformations during the governmental transitions was the enactment of the Indonesian Long-Term Development Plan, *Rencana Pembangunan Jangka Panjang Nasional* (RPJPN), for 2005-2025.

This plan is the reference for all components of Indonesian society (government, communities, and businesses) in realizing ideals and national objectives in accordance with the vision, mission and agreed goals, so that all efforts of development actors are synergistic and coordinated.

The objectives of the Indonesian Long-Term Development Plan of 2005 – 2025 are to achieve an independent, fair, developed nation as a foundation for the next phase of development towards a just and prosperous society in the Republic of Indonesia under Pancasila*) and the Indonesian Constitution 1945. The translation of the vision, mission and goals of Long-Term Development Plan are summarised in the following Table:

Table 5.1 The Vision, Mission and Goals of The Indonesian Long-Term Development Plan 2005-2025

Vision	**Indonesia as an independent, progressive, fair and prosperous nation**
Mission	1. Realizing a society that has good morality, ethics, culture, and is based on the philosophy of Pancasila*) 2. Realizing an energized nation; 3. Creating a democratic society based on law; 4. Realizing a secure, peaceful, and united Indonesia; 5. Achieving equitable development and justice; 6. Realizing a beautiful and sustainable Indonesia; 7. Realizing Indonesia as an independent island state, advanced, powerful, and based on national interests; 8. Realizing Indonesia plays a significant role in the international community.
Goal Highlights	1. The realization of Indonesian society that has good morality, ethics, culture, and civilized; 2. Establishing a nation that is competitive

	to achieve a society that is more prosperous; 3.The realization of a democratic Indonesia, based on law and justice; 4. The realization of security and peace for all people and the integrity preservation in the territory of the Republic of Indonesia and the sovereignty of the country from all threats, both from domestic and overseas; 5. The realization of the construction of a more equitable and fair; 6. The realization of making Indonesia beautiful and sustainable; 7. The realization of Indonesia as an archipelagic nation independent, advanced, powerful, and based on national interests; 8. The realization of the increased role of Indonesia in the international community.

*) Pancasila is Indonesian state philosophy which has meaning in every Indonesian life aspect, society and the state should be based on the value of the Divinity, Humanity, Unity, Democracy and Justice.

Source: The Law no.17/2007

Planning and development oversight in the period of 2005 – 2025 begins with the implementation of the direct election of the heads of government from central to local levels, and continued with the preparation of the National Development Plan based on Law No. 25 of 2004. In 2010, Law No.17/2010 ratified the basic planning policy and the National Long-Term Development Plan (RJPN) with five-year medium-term development plan (RPJMN) scenarios.

The idea of 20 year period of the National Long-Term Devlopment Plan can be explained by Clarke's (1992) studied that the onset of urbanization in developing countries can lead to a doubling of cities population size over the following 15-20 years. This trend produces increased demands for meeting human needs such as residential, commercial and community services. Since land is a key element of all urban development, spatial plans, which typically intend to control the built environment, designate land uses, capacities for development and urban area utilization, are extremely important to national government.

The RPJP 2025 sets policy directions and the priorities to be pursued in the National Medium-Term Development Plan (RPJMN), formulated for five-year periods between 2005-2025. The five-year period, like the 20 year plan, can be derived from Clarke's 1992 study. He argues that the doubling of population numbers of a particular regions in the next 20 years is likely to lead to long-term social and environment instabilities as well as monetary problems at national, province and local scales. But planning and development programmes should focus on short-to-medium term (5-10 year) policies and strategies to monitor urban and regional development.

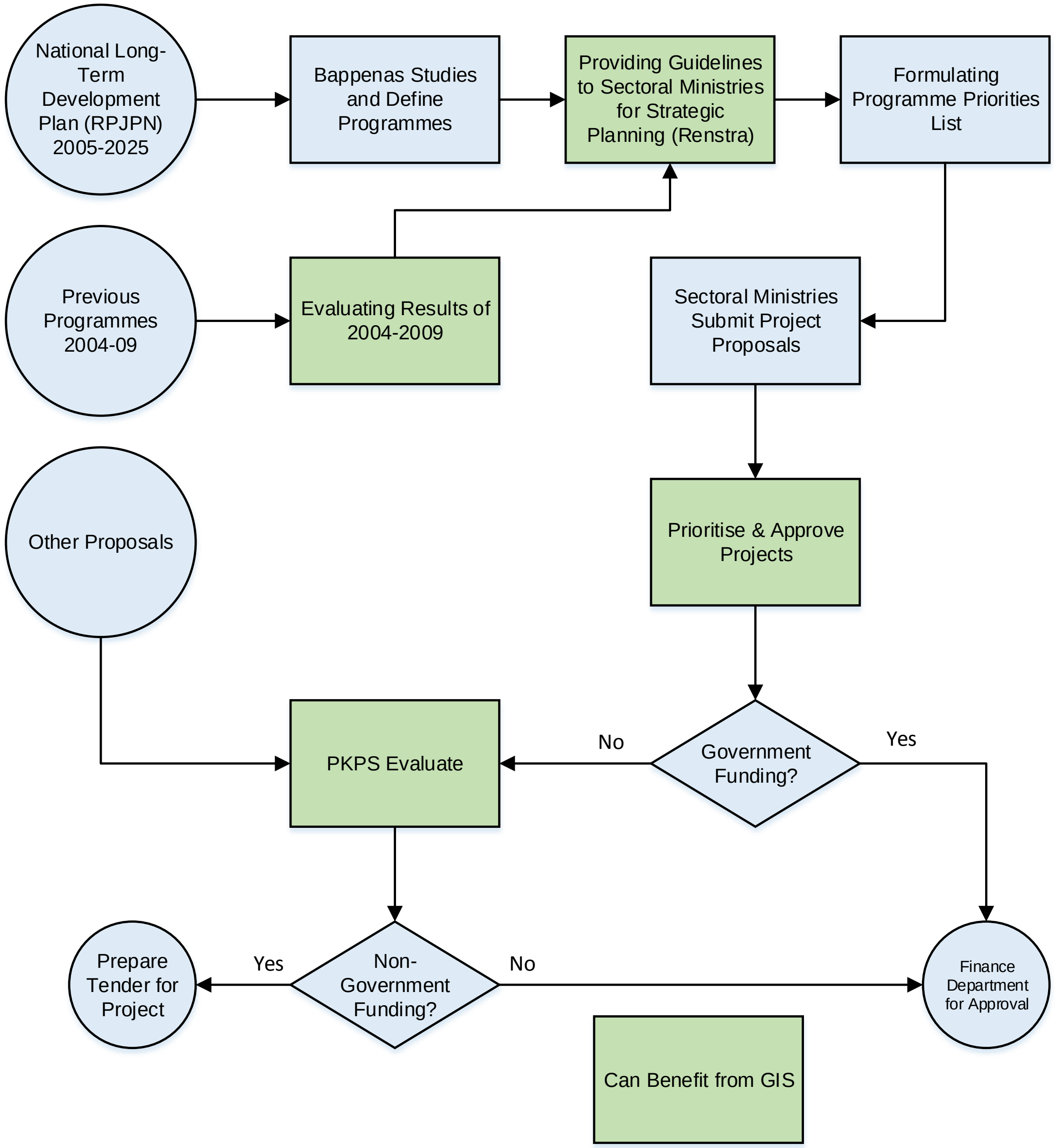
For Indonesian case, a further reason for the five-year periods of the Medium-Term Development Plan (RPJM) is related to the period of office of the Indonesian President to implement his/her agenda while the short term development period of one year is related to Presidential Cabinet work in realizing the President's vision and mission during one period of office.

5.3.2 How can spatial data and information contribute to the Indonesian Development Plans process ?

The Indonesian Ministry of National Development and Planning (BAPPENAS) Report as the Ministry that is responsible for preparing Indonesian development plan, commissioned a study from the Indonesia Infrastructure Initiative (INDII) in

2010 on GIS for infrastructure development. The study examines the potential for GIS usage to support BAPPENAS performance, including the preparation of RPJPN, RPJMN and RKP. This section discusses spatial data and information usage in Indonesian development plans in the light of this Report.

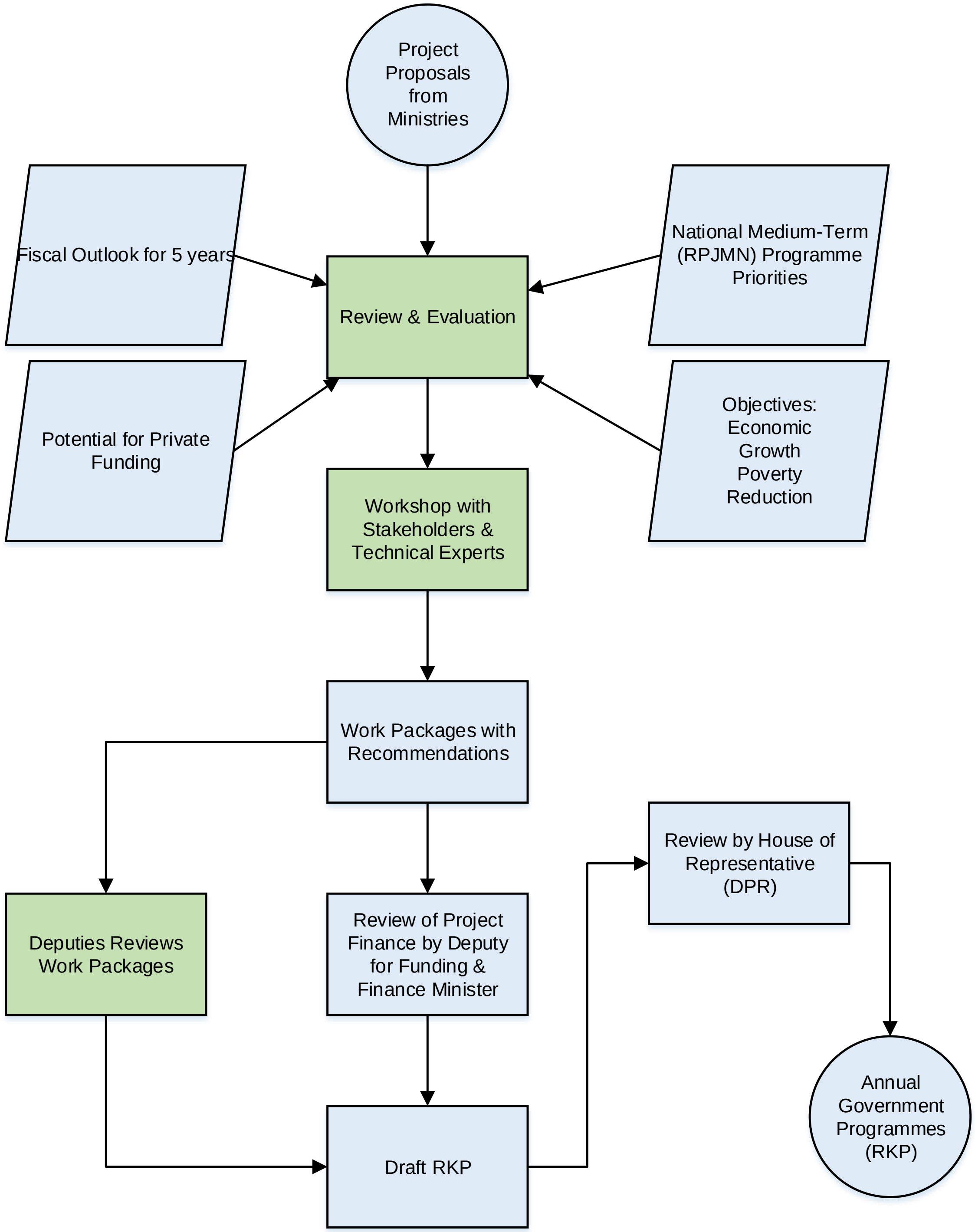
As discussed in the previous section, the Indonesian development plan is divided into three development plans according to the difference in the time period of development: namely, RPJPN which covers 20 years; RPJMN for periods of five years; and RKP for periods of one year. The study by INDII of spatial data and information usage in the national RPJPN is summarised in the following diagram (Figure 5.5) and for the national RPJM and RKP can be seen in Figure 5.6.



Source: INDII (2010, pp.53)

Figure 5.5 Potential Spatial Data and Information Usage Fit in The National Long-Term Development Plan

Figure 5.5 shows that spatial data and information usage in translating the vision and mission of RPJPN 2005 - 2025 is relevant at the stages of prioritising development programmes and for appraisal of development outcomes. Further evaluations of development activities that have the potential for spatial data and information usage are the RPJMN evaluation of prior periods for feedback and improvement in the next RPJM period, as well as the evaluation of public-private partnerships (PKPS) programmes.



Source: INDII (2010, pp.55)

Figure 5.6 Potential Spatial Data and Information Usage Fit in the National Medium-Term Development Plan (RPJPMN) and Annual Government Work Plan (RKP)

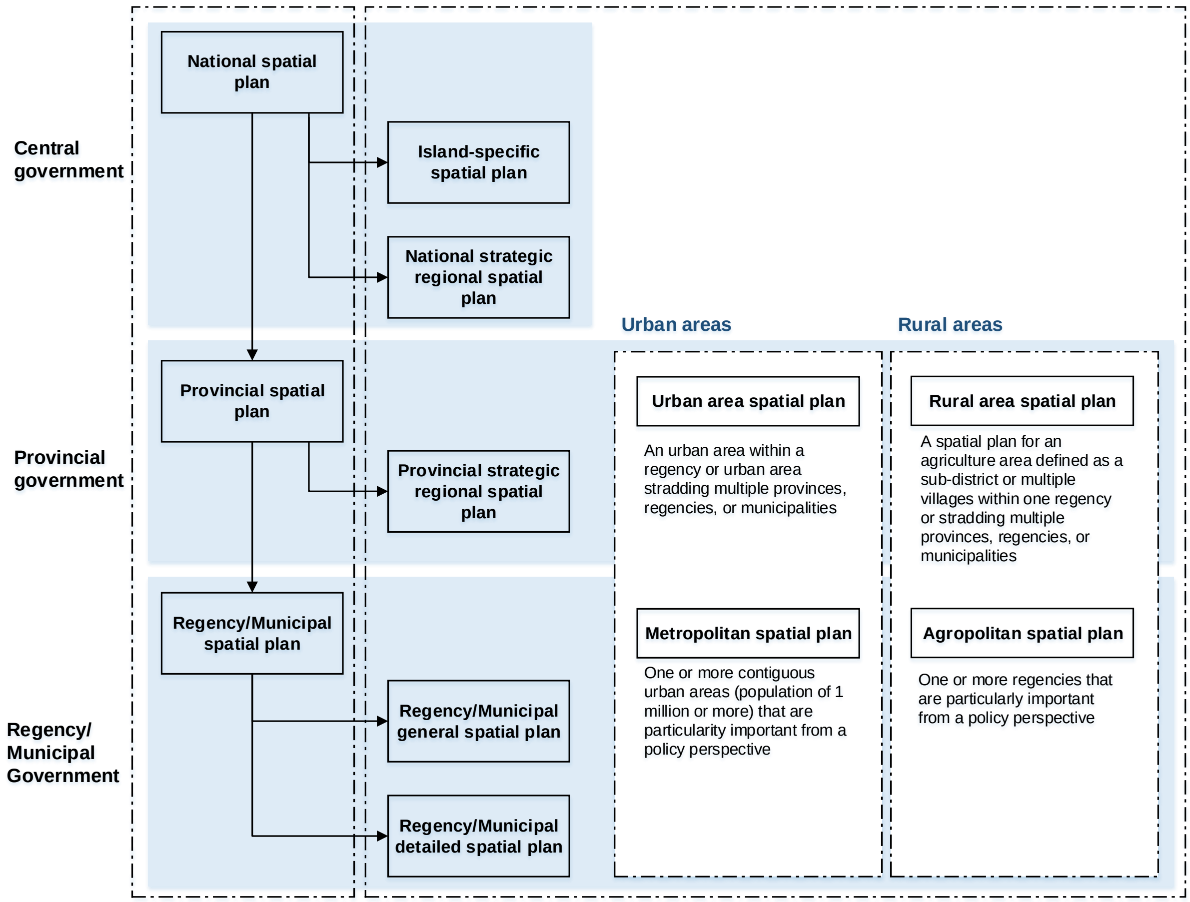
The potential for spatial data and information usage in the spatial development system can be implemented by examining the formulations of regional development priorities and development projects approval set in RPJPN 2005-2025. Spatial analysis of the particular regional characteristics can be identified as socio-economic development issues as the basis for deciding priority development programmes in the selected regions.

Overall, spatial data and information usage in development plan documents are not stated explicitly, but examination of the INDII indicates that there is potential for spatial data and information to be used in the audit, assessment and evaluation activities which consider to the development plan goals. In the comprehensive Indonesian development and planning context, development policy language needs to be translated into spatial planning policy language requiring spatial information visualization for the implementation of the government's agenda. Further spatial data and information usage in Indonesian spatial plans will be discussed in the next section.

5.3.3 The Indonesian spatial planning system

The previous section has already mentioned that in terms of the comprehensive Indonesian spatial policy, the manifestation of the development plan is the Spatial Plan, *Rencana Tata Ruang Wilayah* (RTRW). It becomes the guidelines for all government levels to manage natural resources optimally and sustainability with attention to disaster risk, and as well is the basis for the development of national welfare.

In terms of the spatial planning practices in Indonesia (including the regulation, development, implementation, and monitoring), the government has enacted Law No.26 of 2007. The law regulates the spatial planning system at the national, province and municipality also regency levels (See figure 5.7).



Source:
http://www.mlit.go.jp/kokudokeikaku/international/spw/general/indonesia/index_e.html

Figure 5.7 The Hierarchical Spatial Planning System in Indonesia

The Spatial Plan makes both general and detailed plans of particular areas. A general spatial plan consisting of spatial structure plan and a land use plan, which is formulated based on administrative areas. The spatial structure plan guides the public service networks that are connected by the infrastructure networks system between different governmental administrative areas (national strategic sites, provinces, municipalities and regencies); and the land use plan is defined as a landuse planning concerned with environment protection and built environment areas.

The detailed spatial plan for a particular area is based on the strategic value of the local approaches and activities with zoning schemes. The preparation of a detailed plan is intended as a spatial plan management tool, and as a basis for setting zoning regulations. The zoning regulations set the terms and conditions for the control of land utilisation for each block/zone designated in the detailed spatial master plans.

Spatial structure and land use plan visualisation are specified Government Regulation No. 8 of 2013 (PP 8/2013). PP No. 8 / 2013 concerns methods for creating the spatial planning maps in relation to the level of map accuracy, including:

1.Geometric accuracy - geospatial reference system, scale and mapping unit.
2. Details of the spatial planning element maps and symbols.

The relationship between the spatial plan maps and the elements of the spatial planning system - the National Spatial Plan (RTRW Nasional); the Provincial Spatial Plan (RTRW Provinsi); and the Municipality / Regency Spatial Plan, (RTRW Kota or RTRW Kabupaten) – will be discussed in the next section.

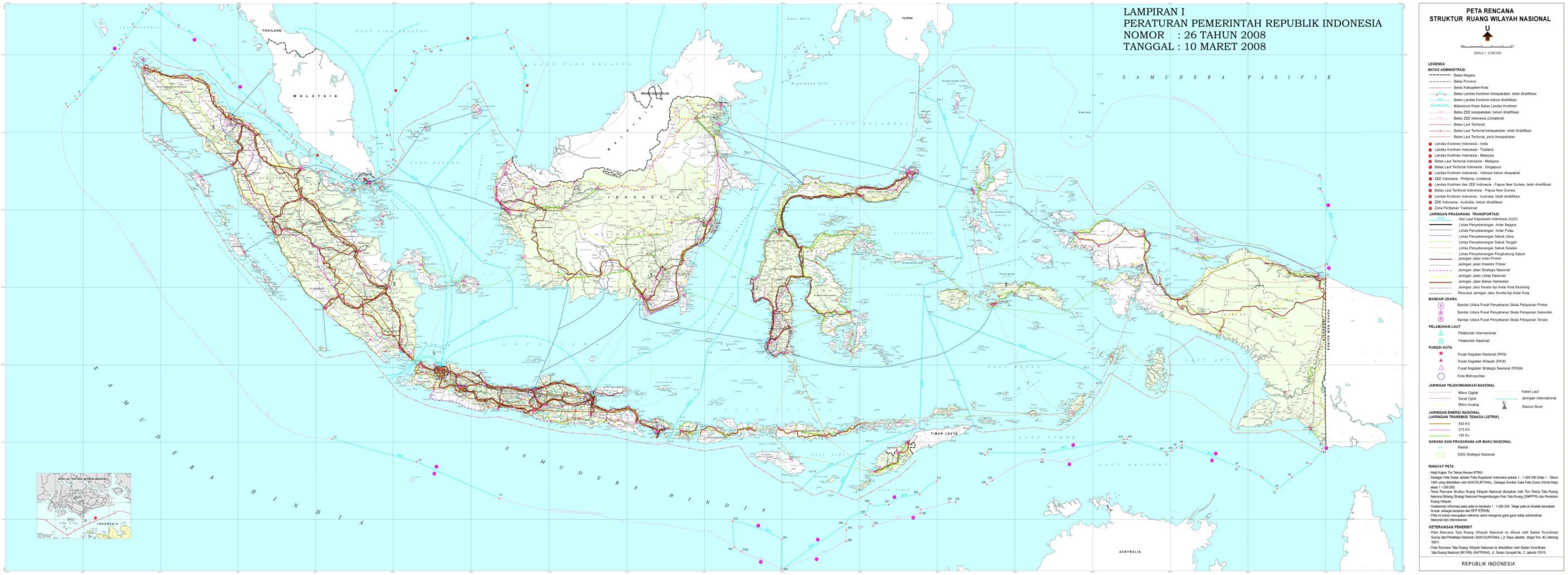
a. The National Spatial Plan

The Indonesian National Spatial Plan stipulated under Government Regulation No 26 of 2008 is a reference for government agencies at all levels to determine the location and spatial utilisation of the government's agenda and programmes. The purpose of national spatial planning reflects the integration of development sectors, regions, and between stakeholders. Policy and national spatial planning strategies are formulated by considering science and technology as ways of making plan, availability of data and information, as well as finance for development (GoI, 2008).

The National Spatial Plan is formulated for a period of 20 years illustrating the spatial dimension of the Long-Term Development Plan visions. The National Spatial Plan has functions in supervising spatial plans at the provincial and municipality/regency levels to guarantee adherence to laws and consistency amongst systems of planning and advancing congruity of arrangements and activities amongst areas. It also takes the lead in giving providing basic information and data on the conditions of recent spatial development (GoI, 2008).

The contents of the National Spatial Plan consist of the National Spatial Structure Plan (*Rencana struktur ruang*), the Land Use Plan (*Rencana Pola Ruang*), the establishment of national strategic sites and the national governmental programme indicators (GoI, 2008). In terms of translating the visualisation of the National Sptial Plan into the map, there are two elements which are regulated by PP No.8 / 2013: the National Structure Plan and the National Land Use Plan. The fundamental aspects of the National Spatial Plan Maps use 1: 1,000,000 map scale. (See Figure 5.8 for the Indonesian National Structure Plan). Therefore, a study of spatial data and information usage in the National Spatial Plan needs to focus on both elements.

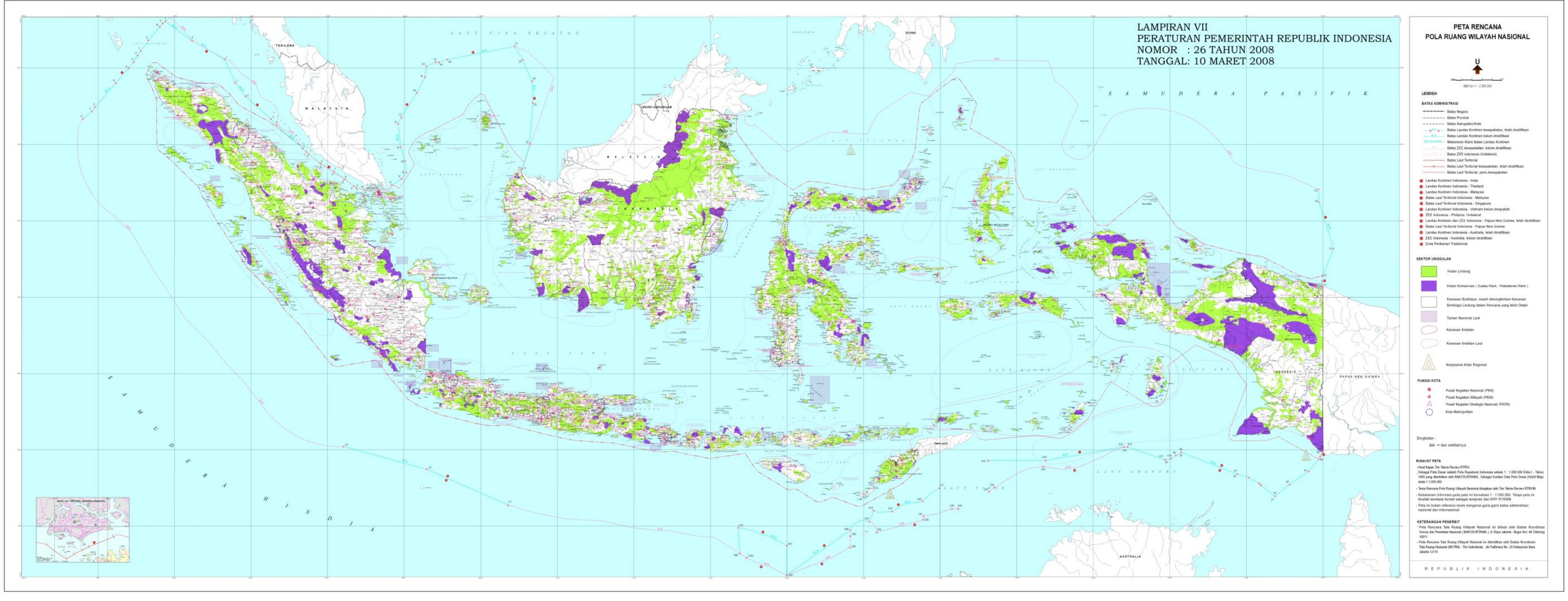
The National Spatial Structure Plan looks at national urban systems associated with the rural population in a service area and the main infrastructure network systems which have national socio-economic impact. The national urban system consists of urban areas with a covering national and local scale activity centres. The activity centre is supported and equipped with a regional infrastructure network, with levels of service tailored to the hierarchy of activities and service needs. The major infrastructure networks are a primary system developed to unify the territory of the Republic of Indonesia and in addition, to serve national scale activities, including transportation, electrical and energy, telecommunications and water resources network systems.



Source: BIG, 2008 with permission to re-print from BIG

Figure 5.8 The Indonesian National Structure Plan Map

The National Land Use Plan describes the land use plan, either for national strategic built environment utilisation or protected areas. The definition of a National Protected Area is an area in which development is either not permitted or is restricted. It is a space which functions mainly for protecting the health of the environment including natural resources and artificial resources, cultural heritage and history, as well as to reduce the impact of natural disasters. Built Environment Areas have a national strategic value developed to support the functions of national defence and security, regional strategic industry, urban and metropolitan areas, and agricultural regions according to the legislation of licensing and management of a government authority (See Figure 5.9).



Source: BIG, 2008 with permission to re-print from BIG

Figure 5.9 The Indonesian National Land Use Plan Map

b. The Provincial Spatial Plan

The Provincial Spatial Plan is the reference for province and local government agencies (*i.e.* municipality/regency levels) for determining land use and strategic locations. The Provincial Spatial Plan enshrines integrated alignment and balanced development amongst municipalities/regencies regions, as well as to synchronise different developmental sectors. The duration of the implementation of Provincial Spatial Plans aligns with the 20 years at the national level. The Provincial Spatial Plan has similar content elements as the national level: the Spatial Structure Plan, Land Use Plan, the establishment of a strategic sites plan, and land use direction and controls. For the purpose of this research, analysis of the contents of spatial plans focuses on the spatial structure and land use plans either at province or regency/municipality levels.

The Provincial Structure Plan is the embodiment of the urban system within the province and the infrastructure network of the province being developed to integrate entire areas at a province level. Spatial structure takes the form of a regional hierarchy starting with the primary activity centres characterised as urban activities, and moving to tertiary activity centres characterised as areas developed predominantly by a particular sector, for example agriculture. The linkages between activity centres in the province are made by the network systems of transportation, energy and electricity, telecommunications, and water resources (including the entire upstream dam / watersheds reservoir areas).

The Provincial Land Use Plan is a picture of the provincial land use system, either having functions for protecting designated areas or built environment utilities. Provincial Protected Areas are ecologically protected areas in which the ecosystem covers more than one regency/municipality and the management is the authority of the provincial government. Built Environment Areas are defined as residential, commercial, mining exploration, industrial estates and tourist resorts areas, having a strategic value for the provincial economy.

In terms of translating the visualisation of the Provincial Spatial Plan into the map, like the national level, there are two elements regulated by PP No.8 / 2013: the Provincial Structure Plan and the Provincial Land Use Plans. The basic provincial spatial maps are at a scale of 1: 250,000.

For provinces with coastal and marine areas, the Spatial Plan Map must be equipped with bathymetry data. For areas bordering other provinces, the Spatial Plan Maps are prepared after the province government coordinates with the adjacent provincial government. Information on the Provincial Spatial Plan Maps shows the borders of two or more provinces with a five kilometre buffer along the bordelines as a neutral area. Coordination between adjacent provincial governments is a crucial point for spatial plan integration. Relevant to the research topic, spatial data between adjacent provinces is sensitive to potential conflicts, for instance, in land disputes. Thus, open data with specifically spatial data development and sharing is important as a geographical visual communication to achieve spatial plan integration and consensus.

In terms of the Provincial Spatial Plan formulation, there are many steps that need to be submitted to government regulation, such as spatial plan proposal; checking the completeness of spatial plan documents by BKPRN; discussion of spatial plan proposals with BKPRN; and spatial plan ratification. Also the preparation of a Provincial Spatial Plan involves the relationships between the provincial government, the Ministry of Home Affairs, BKPRN, BKPRD Province and BIG. The Provincial Spatial Plan formulation procedure can be seen in Figure 5.10

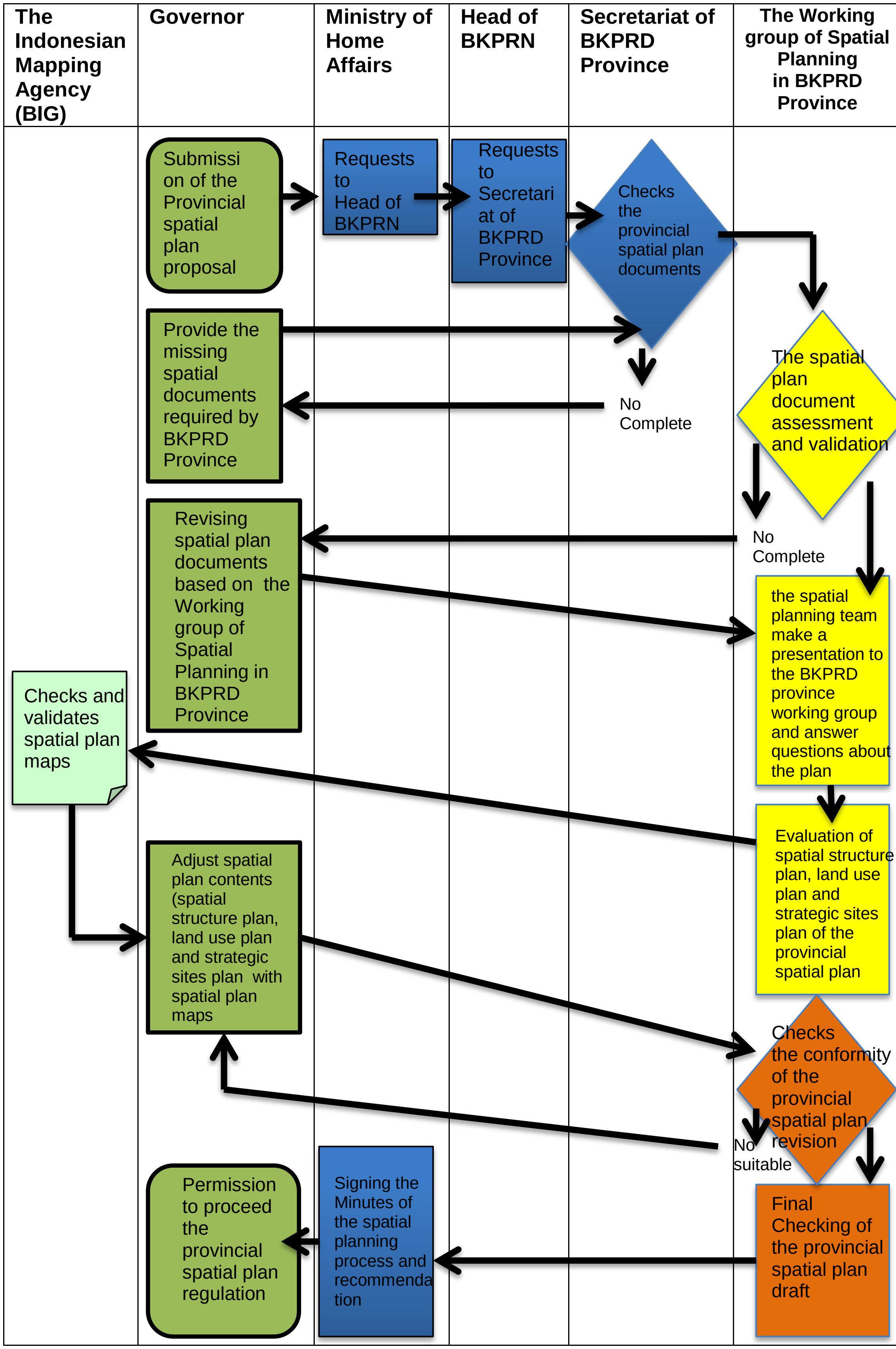


Figure 5.10 The Provincial Spatial Planning Procedure From Proposal To Enactment

Figure 5.10 shows that preparation of the Provincial Spatial Plan starts with the submission of the spatial planning proposal by the provincial Governor to the Minister of Home Affairs. The Minister requests the head of BKPRN to follow up the request of the governor for the formulation of a spatial plan. The head of BKPRN then refers the request from the province government to the BKPRD Province secretariat. The BPKPRD Province secretariat checks the spatial planning documents. If the documents are not complete, they are returned to the provincial spatial planning team to provide the missing documents required by BKPRD Province. If all documents are correct and meet all BKPRD Province requirements the next stage is the spatial plan document assessment and validation by the spatial planning working group in BKPRD Province.

As discussed earlier, the Provincial Spatial Plan is complemented by a spatial structure plan, a land use plan and strategic regional maps. Technicalities of these maps are checked and validated by BIG. Spatial plan maps checking and validation by BIG conducted after the spatial planning team make a presentation to the BKPRD Province working group and answer questions about the plan. Spatial plan maps are required meet national standards. Once the spatial planning working group agrees that all the requirements of both contents and formats of spatial planning have been met, the spatial planning document is submitted to the Ministry of Home Affairs for signing the Minutes of the spatial planning process and recommendation to proceed to draw up regulations. The final step is returning the spatial plan document and spatial maps to the Governor for the spatial plan regulation to pass through the Assembly of the Provincial Parliament.

c. The Municipality and Regency Spatial Plans

The Municipality and Regency Spatial Plan act as the guideline for local governments (municipality and regency, also district (*kecamatan*) levels) to set the development locations, as well as for local government planning programmes.

In terms of translating the visualisation of the Municipality and Regency Spatial Plan into the map, like the national and provincial levels, there are two elements regulated by PP No.8 / 2013: the Municipality and Regency Structure Plan and the Land Use Plan. The maps are at a scale of 1: 25,000 for municipality and 1:50,000 for regencies.

Furthermore, for municipalities and regencies with coastal and marine areas, the Spatial Plan Maps of the regency and municipality must be equipped with bathymetry data. For regency/municipality areas bordering other regency/municipality areas, Spatial Plan Maps are prepared after the regency/municipality coordinates with the adjacent regency/municipality. Information on the municipality / regency Spatial Plan Maps shows the borders other municipalities / regencies, with a 2,5 kilometers buffer along the border lines as a neutral area.

Like the province level, coordination amongst neighbour municipality/regency governments is a crucial point for spatial plan integration. Thus, open data through spatial data development and sharing can mediate political negotiation between areas with similar interests to achieve planning management consensus.

In terms of the Municipal/Regency Spatial Plan formulations, many activities need to be submitted to government regulation, such as spatial plan proposal; checking completeness of spatial plan documents by BKPRD Municipality/Regency; discussion of spatial plan proposals with BKPRD Municipality/Regency; and spatial plan ratification. Also the preparation of a Municipal/regency Spatial Plan involves the relationships between the municipal/regency government, Ministry of Home Affairs, BKPRN, BKPRD Municipality/Regency and BIG. The Municipal/Regency spatial plan formulation procedure can be seen in Figure 5.11.

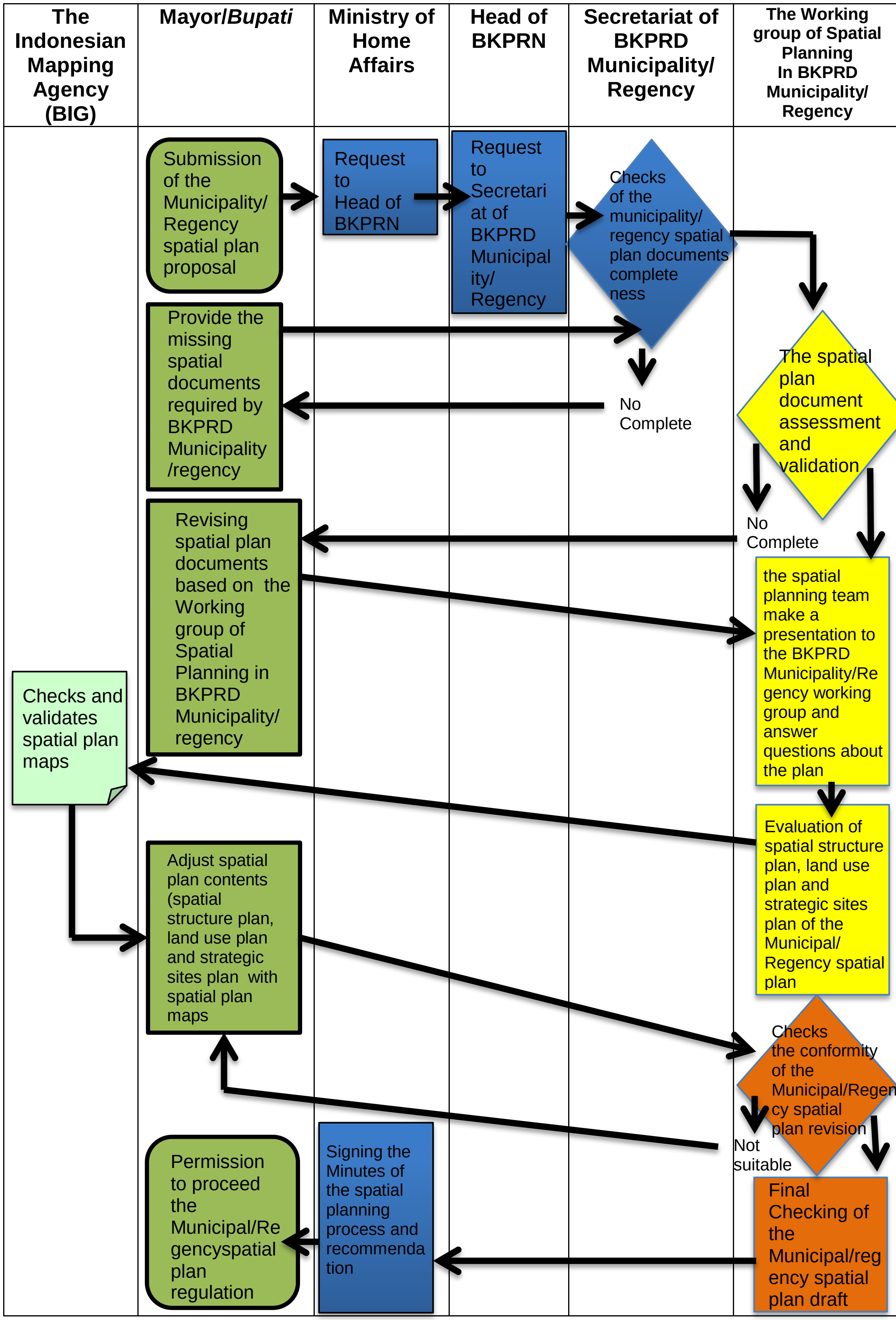


Figure 5.11 The Municipal/Regency Spatial Planning Procedure From Proposal To Enactment

Figure 5.11 shows that the municipal/regency spatial planning preparation starts from the submission of the spatial planning proposal by Mayor/*Bupati* to Minister of Home Affairs. Minister of Home Affairs asks the head of BKPRN to follow up the request of the mayor/*Bupati* for the formulation of the spatial plan. The head of BKPRN refers the request from the municipal/regency governments to the BKPRD Municipality/Regency secretariat which then checks the documentation. If the documents are not complete, they are returned to the municipal/regency spatial planning teams to provide the missing documents that required by BKPRD Municipality/Regency. If all documents are correct and meet all BKPRD Municipality/Regency requirements, the next stage is the spatial plan document assessment and validation by the spatial planning working group in BKPRD Municipality/Regency.

As discussed earlier, the Municipal/Regency Spatial Plan is complemented by spatial structure plan, a land use plan and strategic region maps. Technicalities of these maps are checked and validated by BIG after the spatial planning team make a presentation to the BKPRD Municipality/Regency working group and answer questions about the plan. Spatial plan maps are required meet national standards. Once the spatial planning working group agrees that all the requirements of both contents and formats of spatial planning have been met, the spatial planning document is submitted to Ministry of Home Affairs for signing the Minutes of the spatial planning process and recommendation to proceed to draw up regulations. The final step is returning the spatial plan document and spatial maps to the Mayor/*Bupati* for the spatial plan regulation to pass through the Assembly of the Municipal/Regency Parliaments.

In the Provincial, Municipal and Regency Spatial Plan ratification process, spatial data and information need to be included as a matter of technical spatial plan maps completeness before spatial plan documents can become regulations and need to have been checked by BIG before plans are ratified. BIG supervision procedure of spatial plan maps will be discussed in the next section.

d. BIG oversight of the formulation of spatial planning policy maps

When Law No.26 of 2007 on spatial planning was enacted, all levels of government were required to make spatial plans, including spatial planning maps, for a period of 20 years. The regulation of spatial plan maps are regulated by Article 14 Sections 5b which states that "*General spatial plan comprise of planning areas which wide-scale on the spatial plan map needs details of spatial plan policy formulation prior to implementation.*" Article 14, Section 7 "*further provisions on the level of accuracy of the spatial planning map is set by government regulation.*"

The mechanisms for developing spatial maps are set out in policies from derived Spatial Planning Law, namely Government Regulation (PP) No. 8 of 2013 concerning the accuracy of the spatial plan maps. This PP covers technical preparation of spatial maps ranging from the required thematic maps in spatial plans, reference system, map scale, mapping units and symbols. It also covers associated procedures for the supervision of the preparation of spatial plan maps in order to acquire technical recommendations from BIG under Regulation of the Head of BIG No. 6 of 2014.

The supervision by BIG of spatial plan map production aims to ensure technical accuracy and valid spatial data and information as a reference for spatial plan implementation. The inspection of spatial plan maps covers six aspects:

1. Geometric position of base map from BIG;
2. Completion and updated basic spatial data assessment for the base map defined by BIG;
3. Completeness of thematic maps with in accordance with the Ministry of Public Works Regulation No. 20 / PRT / M / 2007;
4. The consistency of spatial plan maps with spatial plan documents that include spatial structure, land use and special areas / strategic plans adjusted with base maps and thematic maps;

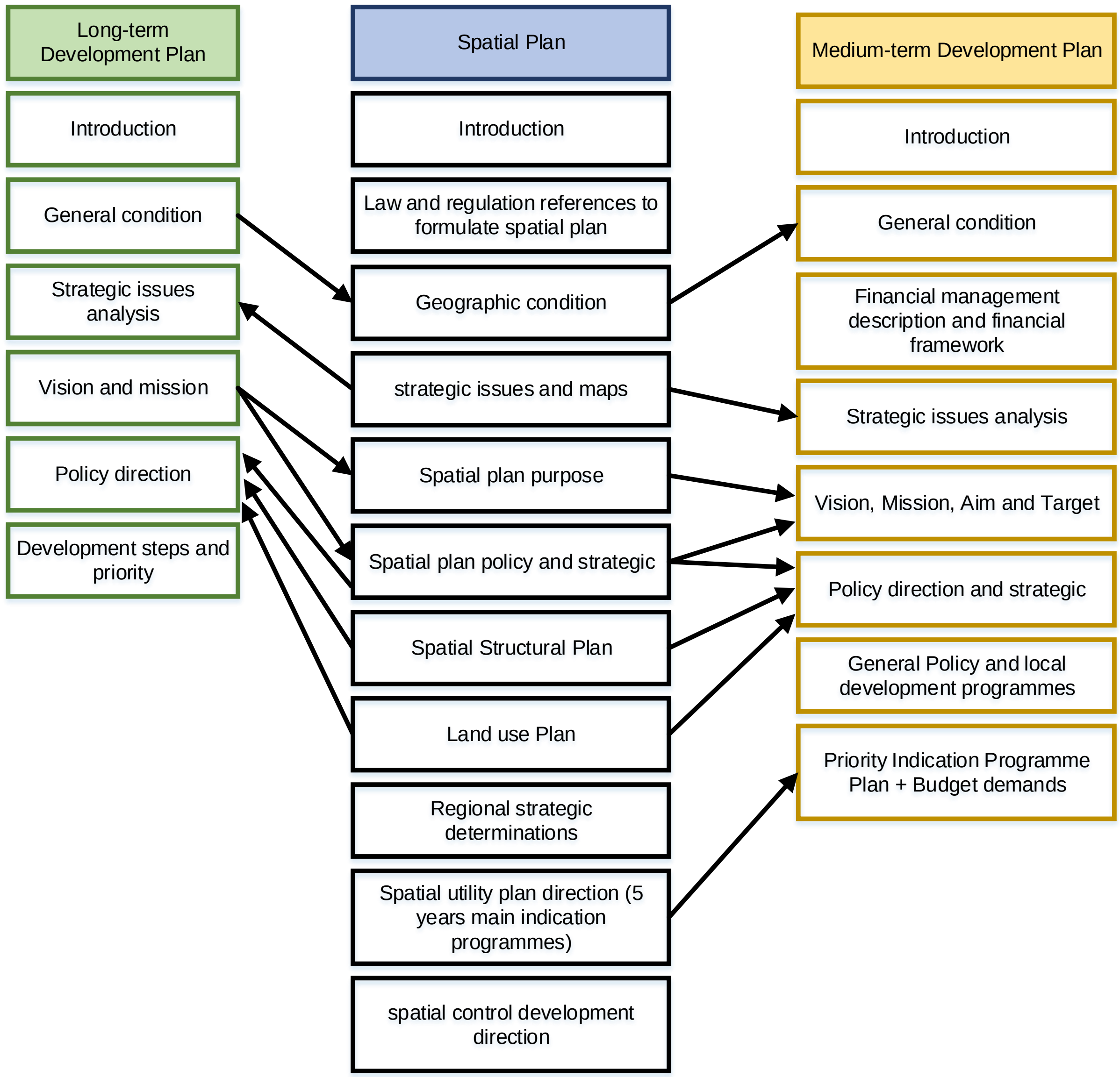
5. The consistency of spatial plan maps with provincial/municipal/regency legislation/regulation according to the spatial structure, land use and special areas/strategic plans that meet with the existing regulations;
6. Cartographic presentation with the assessment of symbols, colours, and notation in agreement with Government Regulation No.8 of 2013.

Source: BIG, 2014d

Generally, the supervision procedure of spatial plan maps provides clear guidelines, but obstacles are encountered is the consultation process carried out directly with the mapping agencies nationwide. The supervision method through direct face-to-face contact between applicants and official BIG staff has been a major obstacle to map development process spatial plans until today, because of it takes high cost and long time spatial plan process. There is a need for alternative ways of consulting on the production of the spatial maps, for instance, by e-consultation methods.

5.4 Synchronizing the Indonesian Development Plan with Spatial Plan

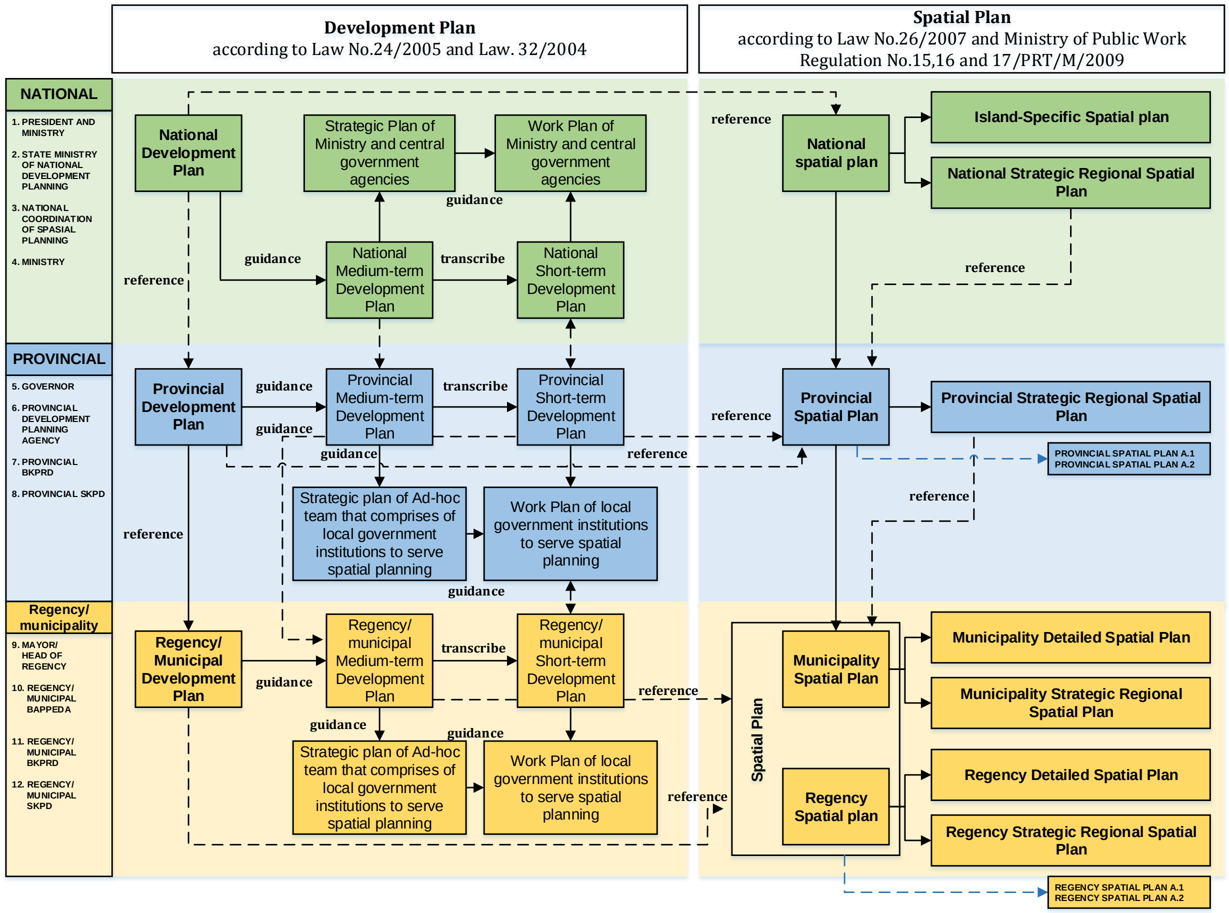
Spatial data or information usage has a crucial role in spatial planning processes to translate the vision, mission and strategy of the Long-Term Development Plan (RPJP) and Medium-Term Development Plan (RPJM) into the Spatial Plan (RTRW). For instance, in RPJP and RPJM, the role of spatial data and information is to describe the general conditions of a region, where the RTRW is translated in the terminology of the region's profile (See Figure 5.12).



Source: PPTRA BIG (2015)

Figure 5.12 Relations between RPJP- RTRW-RPJM

Aspects of the RPJP and RPJM, analysis of strategic issues, policy direction and development strategy is translated into the RTRW with the incusion of spatial information in the discussion of strategic issues, spatial structure and land use plans. Especially for RPJM, which requires more detailed information for the five year period of RPJP, an indication of the priority programme plans and funding needs to be translated in the land use plan directives enshrined in RTRW (main five-year indication programmes). The detailed relationship between Indonesian development and spatial plan can be seen in the following Figure 5.13.



Source: PPTRA BIG (2015)

Figure 5.13 The Detailed Relationship Between The Indonesian Development Plan and The Spatial Plan at All Governmental Levels

In summary, synchronization and consistency becomes imperative in every interrelated spatial policy, so that the various implementation efforts do not lead to conflict. In addition, spatial data and information has a crucial role in translating development strategies into the implementation of development programmes in the spatial planning context.

The Development Plan and Spatial Plan Policy decided by the government has an impact on civil society, especially since the 1992 UN declaration on sustainable development emphasized creating a good governance agenda in which implementation should involve communities in urban and regional planning.

Public participation in the planning and development process should listen to what the public demands to improve their quality of life where they live. It means the programmes are drawn up by government experts but not necessarily in the interest of elites in society. Insight on a study of public participation characteristic under planning and development context will be discussed in the next section.

5.5 Public participation in the Indonesian spatial planning process

Public participation in the spatial planning process in Indonesia is stipulated in Government Regulation (PP) No.68 of 2010 as an amendment of PP No.69 of 1996. The Government Regulation on Implementation policies contains rights and obligations as well as forms and procedures for public participation in the spatial planning process.

Government Regulation No. 68 of 2010, ‘the public’ is referred to as: "*an individual, group of people, including customary law communities, corporations, and / or other non-governmental stakeholders in the spatial planning process*"; while the role of the community in this Regulation is stated to be: "*The active participation in spatial planning land use procedures and controls* " (GoI, 2010b).

The procedure for public participation at the local level is stipulated under the Ministry of Home Affairs Regulation, (PERMENDAGRI), No. 56/2014 on Procedures for community participation in the process of spatial planning at a local level. The regulation is similar to Government Regulation No. 68 of 2010 (Article 6), with additional aspects of: the object of public participation, the formal aspects of the institutional arrangements, and spatial planning stages (GoI, 2014f).

Public participation in Indonesia is carried out in the form of presentation of information, suggestions and advice orally and in writing through a variety of media information. In the context of delivery of information from citizens to government agencies, spatial visual images are usually used as the negotiation media to achieve planning and development consensus. Public participation can be carried out by community groups and organisations, as well as professional organisations conducting advocacy planning for authorised institutions.

Types of public participation in the formulation of the development plan and the spatial plan include:

a. Identifying development and planning potentials and problems;
b. Providing input to the formulation of the development plan and the spatial plan;
c. Providing information or opinions on the spatial planning strategies;
d. Filling an objection to, or criticism of, the draft of the development plan and the spatial plan;

5.6 Summary of Chapter

The current Indonesian government been liable to various decentralization transformations, and government organisation has experienced significant changes following the decentralisation moves of 1998 and the subsequent legal enactments in 1999. The particular impacts of decentralisation managed in individual geographical areas. Before 1998 all regional and local government authority arrangements had to be affirmed by central government before they were made. After 1998, all regional and local governments authorities gained the ability to make agreements that then became law after the agreement had been ratified by central government.

One noteworthy impact has been the security of asset management, obligation and staff amid a time of expanding ICT accessibility that has created an expanding enthusiasm for computerized information sets, which specifically in terms of this research topic relates to spatial data management. This chapter has outlined the form of the Indonesian government system and provided a general illustration of planning and development actors in Indonesia. The initial development phases of the planning process require negotiations between the Executive, which has the role of formulating the planning and development agenda with the Legislature as a state agency in charge of enacting policies as legal regulations.

The significant laws relating to the Indonesian planning and development system is Law No. 25/2004 on the National Development Planning System, *Sistem Perencanaan Pembangunan Nasional* (SPPN), as a replacement of the outlines of state policy, *Garis-garis Besar Haluan Negara* (GBHN) as a result of the Indonesian Constitutional 1945 amendments. The success of SPPN is supported by the State Budget Allocation Plan stipulated in Law No.17 / 2003 of State Budget at each government level.

The details of SPPN development programmes are embodied in the development of the Long-Term Development Plan, *Rencana Program Jangka Panjang* (RPJP), with the strategy stages undertaken in the five-year Medium Term Development Plan, *Rencana Program Jangka Menengah* (RPJM) form and the details of every annual stage of strategy in the Government Work Plan, *Rencana Kerja Pemerintah* (RKP). The work plan for the direction of development of SPPN is a-spatial, and then implemented in spatial form in spatial planning documents, *Rencana Tata Ruang Wilayah* (RTRW) in accordance with Law. No. 26/2007.

Spatial information visualization in development plan documents are not stated explicitly , but studies by INDII indicate that there is potential for spatial data and information to be used in the audit, assessment and evaluation of development plan goals. The spatial plan is formulated as general and detailed plans of particular areas. A general spatial plan is based on the governmental administrative area with the planning contents essences coming from the spatial structure plan and land use plan.

Government Regulation No. 8 of 2013 (PP 8/2013) sets out the methods for creating spatial planning maps and stipulates the level of map accuracy according to levels of government and purposes of the maps as set out in the Spatial Planning Law.

Synchronization and consistency between development plan and spatial plan must be ensured in every interrelated spatial policy, so that the various implementation efforts do not lead to conflict. Furthermore, spatial data and information has a crucial role in translating the development strategies into the implementation of the development programme for the implementation of the government's agenda.

Public participation is intended as a learning process between citizens and government that can directly improve their capacity to reach an agreement. The spatial plan can be seen as an agreement between various stakeholders through a series of ongoing and constructive dialogues. A continuous dialogue process during the formulation of spatial plans will create a mutual learning process to achieve consensus by various parties regarding the arrangement of space.

This chapter has attempted to answer the first research question “Why do spatial data and information have a significant role in Indonesian spatial planning process?”. The evaluation of the success of the implementation of spatial data and information sharing in the spatial planning process cannot be separated from the study of open data and spatial data management at government level. Open data, GIS practices and issues, spatial data management and NSDI in the Indonesian government system will be discussed in the next chapter.

CHAPTER 6

OPEN DATA, GIS PRACTICES, SPATIAL DATA MANAGEMENT AND NSDI IN THE SYSTEM OF INDONESIAN GOVERNMENT

6.1 Introduction

The previous chapter gave an overview of the Indonesian government system, the development and planning mechanisms and public participatory in spatial planning process. This provides the context for spatial data and information sharing analysis in the Indonesian spatial planning process. The implementation of successful spatial data and information sharing to support a coherent spatial planning agenda in Indonesia is highly dependent on the organisational vision to manage better data and information systems.

Spatial data sharing implies inter-agency and public access to official web sites and interactive services and this means a study of spatial data sharing cannot be separated from open data applications. Government agencies are willing to share their data and information with the public to provide explanations of policy and create transparent measures of government performance in the implementation of development and planning agendas. This study of the spatial data and information management by government institutions provides information to be considered in finding the potential for a national spatial data management model.

This chapter discusses open data in the Indonesian government system as a fundamental aspect of spatial data sharing. Following the discussion of open data is the chapter examines GIS practices and issues in Indonesia as an introduction to investigating spatial data management at the central government level. After that, One Map Policy would be discussed following examining spatial data management performance in selected ministries and agency. Finally, this chapter explores the Indonesian government's effort to realize NSDI and answers the second research question: What processes has the central government of Indonesia used to develop NSDI?

6.2 The open data implementation in Indonesia

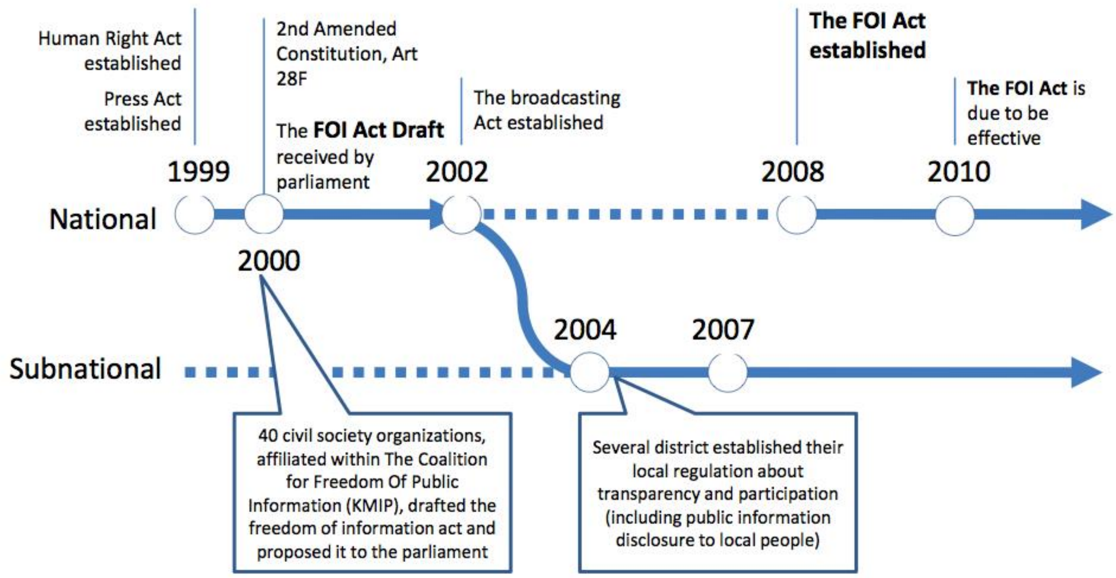
From 1966 to 1998, under the Suharto regime, the distribution of government data and information were very strictly controlled by the state. Access to data and information were subject to very strict regulations; there was no public access to official information, and even inter-governmental institutions found it extremely difficult to exchange data or information without obtaining a recommendations from the heads of government departments (Lim, 2004, Kitley, 1994; Shoesmith, 1994).

The phenomenon of limited access to obtain data and information can be traced by examining Law No. 7 of 1971 concerning principal filing provisions, especially Article 11, Paragraph 1 of the criminal provisions which states "*Whoever intentionally and unlawfully has official data and information without legal procedure may be liable to imprisonment for a maximum of 10 (ten) years.*" (GoI, 1971). In addition, Paragraph 2 states that "*Whoever deliberately or unintentionally passes on the content of official data or information to third parties who are not entitled to know it, the person in charge of keeping the data and information safe may be liable to imprisonment for a life sentence or imprisonment for a maximum of 20 (twenty) years.*" (GoI, 1971). A further provision is found in Government Regulation No. 34 of 1979 on "Depreciation Archive" in the explanation of Article 15 which states that "*Depreciation archives referred to in this government regulation be implemented with due regard to the security and the confidential nature of the archive.* " (GoI, 1979).

Political reform in 1998 marked the collapse of the Suharto regime and brought about fundamental changes to the Indonesian Constitution. Indonesia ratified human rights covenants and amended the Indonesian Constitution 1945 in 2002. One of the amendments guarantees the rights of citizens to access information, as specified in Article 28F of the Amendment: "*Everyone has the right to communicate and obtain information to develop their personal and social environment, and the right to seek, obtain, possess, store, process and convey information by using all available channels*". The Article became the basis for constructing a law on public information disclosure (Saragih, 2010).

The draft of the Indonesian Freedom of Information Act, *Rancangan Undang-Undang Kebebasan Memperoleh Informasi Publik* (RUU KMIP) was first put forward in 2000 by the Indonesian Centre for Environmental Law (ICEL). The difficult negotiation of the RUU KMIP took until 2007, due to tough negotiations between the Executive government under the President's control and the Legislature under The House of Representatives control (Sumrahyadi, 2007).

In April 2008, RUU KMIP was finally passed into the law as the Indonesian Freedom of Information Act, *Undang Undang Keterbukaan Informasi Publik* (UU KIP) (Law No.14 of 2008). Two years later, The Law. No.14 of 2008, has been run effectively upon issuance of Government Regulation No. 61 of 2010 of the Law No. 14 of 2008 guidelines. It took eight years for Indonesian Freedom of Information Act to be ratified, and based on the Indonesian law procedure, the law can be implemented when law derivative, in this context is the Indonesian Government Regulation for the law implementation guideline, is stipulated. Ordinarily, the government regulation enactment from the law ratification takes two years, The situation means to impose Freedom of Information Act in Indonesia needs a 10-year since the 2nd Constitution 1945 amendments in 2000 (see Figure 6.1)



source: Saragih (2010) in http://www.asef.org/images/stories/ccs4/ws%206_alamsyah%20saragih%20indonesia.pdf

Figure 6.1 Establishment of Freedom of Information Act in Indonesia

The ratification of the Freedom of Information Act and regulations was completed in 2010 officially beginning an era of open data in Indonesia. One of the substantial agendas of open government data in this research topic is spatial data sharing in NSDI context. Since 2010, some relevant changes to government structures and public service mechanisms have occurred, which are discussed in the next section.

6.3 GIS practices in Indonesia

Pioneer spatial data and information development in Indonesia started with the establishment of the Indonesian National Survey and Mapping agency (BAKORSURTANAL) in 1969. The scope of BAKORSURTANAL activities in the preliminary period covered the primary survey of national natural resource inventories mapping (BAKORSURTANAL, 2009).

GIS for spatial analysis purposes in developing countries became common after 1988, when the United Nations Centre for Regional Development (UNCRD) launched a series of adoption and diffusion of information systems in urban, regional and development planning agency studies in developing countries, including Indonesia (Takase, 2013; Batty, 1992; Masser, 1986). By the end of the UNCRD programme in the early 1990s, GIS technology has been embraced rapidly in Indonesia.

6.3.1 An overview of historical GIS practices in Indonesia

Pioneer spatial data and information development in Indonesia began with the topographic mapping activities during the Dutch colonial period (1800s) (BAKORSURTANAL, 2009). After Indonesian Independence in 1945, Indonesia established official government agencies to manage spatial data and information. The Government agencies that have been involved from the beginning of spatial data and information development are BAKORSURTANAL and the Indonesian National Space and Aeronautics Agency, *Lembaga Antariksa dan Penerbangan Nasional* (LAPAN).

BAKORSURTANAL is a non-Ministerial institution with the role of coordinating the production of the national base map and has been the pioneer of spatial data and information management throughout Indonesia. Another BAKORSURTANAL services is providing analogue and digital format spatial data for the public (BAKORSURTANAL, 2009). LAPAN is a non-Ministerial Indonesia institution that provides remote sensing satellite imageries. This institution has earth stations to record spatial data such as SPOT imagery, MMS-Landsat and Landsat-TM. Image data from LAPAN can be ordered either in digital or printed format.

Another government agency with a role in supporting the development of GIS and remote sensing in Indonesia is the Government Agency for the Assessment and Application of Technology, *Badan Pengkajian dan Penerapan Teknologi* (BPPT) with specialization in geospatial technology development, such as GIS software development, remote sensing satellite technology development and Unmanned Aerospace Vehicle (UAV) (LAPAN, 2014).

Early in the geospatial technology era (1980s-1990s), some Indonesian government programmes were conducted to build GIS capacity, both in creating geo-data bases and expanding human resources capacity. This include the following projects:

1. LREP 1 (Land Resources Evaluation and Planning) conducted between 1983 – 1990 (ADB, 1996).

   LREP aimed to improve the quality of physical planning and decision-making about the use of natural resources, at national and regional levels. The project also sought to improve capabilities for land resources data, Geographic Information Systems, land use mapping and soil mapping.

2. LREP2 (Land Resources Evaluation and Planning) conducted between 1991 – 2002 (ADB, 2002).
   The Land Resource Evaluation and Planning 2 Project aimed to enhance organisational capacity in BAKORSURTANAL. It also mapped natural resources areas that had not been covered by LREP1.

3. RePPPRoT (Regional Physical Planning Programme for Transmigration) conducted between 1984-1989 (Rais, 1997; Poniman et al., 2004)

   The project aimed to create the basic source of information for national and regional planning in Indonesia. It fuctioned line with the government's strategy of diversification to reduce dependence on oil and gas revenues and more develop agriculture.

4. RePPMiT (Regional Physical Planning for Map Improvement) conducted between 1990 – 1994 (Brinn, 1993)

   RePPMIT project aimed to introduce the results of the RePPProT project study to regional Planning Boards (Bappeda) where the data / maps could used as input for macro physical planning at the provincial level.

5. MREP (Marine Resources Evaluation and Planning) conducted between 1993 – 1998 (Dahuri *et.al*., 1999).

   The purpose of this activity was the development of a national programme to increase organisational capacity for building the necessary geodatabase for marine resources and coastal evaluation and planning utilization through Marine Resource Geographic Information System (GMRIS).

Overall, these programmes produced and provided a vast amount of digital geographic data and information in various spatial themes. The digital mapping activities undertaken during the projects were also adapted to develop a geospatial educational curriculum in Indonesia. The development of skills for this sector was started with the opening of Geography and Geodesy Departments at several universities in the mid-1980s, including Gadjah Mada University (UGM), Bandung Institute of Technology (ITB), and the University of Indonesia (UI), And later, several other universities began to teach GIS and remote sensing related spatial sciences (Soesilo, 1992). Initially, because of the limitations on funds and technology, these studies emphasised concepts and theory rather than practice. But since the 1990s, GIS and remote sensing studies have focused more on practice than theory.

The crucial significant of GIS and remote sensing for spatial planning purposes began to appear in the early 1990s, as a result of the information systems training in developing countries launched by UNCRD. Most government institutions had began to use GIS as a tool for spatial data management as a result of the training. (Soesilo, 1996)

6.3.2 Geographic information issues relevant to the current Indonesian spatial planning system

Indonesia has 34 provinces, 398 regencies and 93 municipalities. In addition, there are 76 National Strategic Sites (KSN) (consisting of 10 border KSNs, and islands spatial planning) that are subject to spatial planning regulation, and for which basic and thematic geospatial information is required to support spatial policies. Law No.26 of 2007, Article 78, Paragraph 4 states that all regional regulations for Regency/Municipality (*Kabupaten/Kota)* spatial plans must be enacted at least three years after the enactment of the Law. Furthermore, provincial spatial plans must be enacted at least two years after the Law was enacted.

However, the 2014 BIG report revealed that not all Indonesian territories had enacted their spatial plans by then. By December 2014, out of from 34 provinces, 398 regencies and 93 municipalities, for 26 provinces, 317 regencies and 81 municipalities had had their spatial plans ratified by the Indonesian House of Representatives (DPR). Therefore, 26,4% of provinces, 32,1% of regencies and 23,6% of municipalities had not enacted spatial plans, mainly because they had not yet obtained approval from BIG for their spatial planning maps. In addition, slow progress in the creation of spatial planning maps was due to lack of supports in obtaining reliable data, technology and human resources. (See Table 6.1).

Table 6.1. Spatial Planning Maps Status in Provincial, Regency and Municipality Level (Per 29 December 2014)

No	Spatial planning maps status	Province	Regency	Municipality
1	Maps have not been consulted yet	9	73	18
2	Dissemination	6	113	24
3	Basemaps availability	4	49	17
4	Thematic maps availability	2	19	6
5	Planning maps availability	4	16	6

6	ATLAS(Recommendation)	9	128	22
	TOTAL	34	398	93
	Mapping Progress	26.4%	32.1%	23.6%

Source: BIG (2014a)

Table 6.1 shows that several areas in Indonesia have not enacted their spatial plans within the time periodic set in Law no.26 of 2007. Based on interviews and observations, (the reasons/causes of) slow approval by BIG can be identified in four main categories:

1. Local governments do not yet give sufficient attention to the importance of spatial data and information in terms of spatial planning policy formulation.
2. Lack of GIS professionals in local governments and local planning consultants lead to less reliable spatial data and information regarding spatial structure and land use plan maps in spatial plan documents.
3. Lack of basic and thematic spatial data and information provision at appropriate map scale.
4. Little guidance for to the development of spatial plan maps which leads to a lack of quality of spatial plan documents.

In addition, the detailed spatial digital map provision from BIG has not covered the whole of Indonesia yet (see Table 6.2).

Table 6.2. BIG Base Map Geospatial Information Availability Until 2014

No	Map Scale	National Cover	Availability	Not accomplish mission yet	Percentage (%)
1	1:5,000	379,012	539	378,473	0.14
2	1:10,000	91,547	1,074	90,473	1.17
3	1:25,000	13,020	3,894	9,126	29.91
4	1:50,000	3,899	2,837	1,062	72,76
5	1:100,000	975	19	956	1,95
6	1:250,000	309	309	0	100
7	1:500,000	94	94	0	100
8	1:1,000,000	37	37	0	100

Source: BIG (2014a**)**

6.4 Spatial data and information management in Indonesian Ministries/agencies relevant to spatial planning policy formulation

During the time of this research, there have been changes of the Indonesian government system after the Legislative elections in April 2014 and the Presidential election in July 2014. The inauguration of the President and Vice president and the establishment of a new Executive Cabinet in October 2014 may affect the entire development system including spatial planning activity.

A new Ministry of Agrarian and Spatial Planning was established, and there was a change in spatial planning coordination in Indonesia. However, when conducting fieldwork during January-April 2015, the changes hadn't come through the system yet and the people were interviewing were still in the same jobs and the same roles as before. Hence, this research still studies the institutional spatial planning coordination *ad hoc* team system under the National Spatial Planning Coordinating Board (BKPRN) that already explained in previous chapter (Chapter 5, setion 5.2.2).

The next stages discussions focus on the spatial data usage and processing, and summarise the identification of the main spatial data management issues at selected central government institutions.

6.4.1 Spatial data and information management in the Ministry of Agrarian Affairs and Spatial Planning

a. Introduction

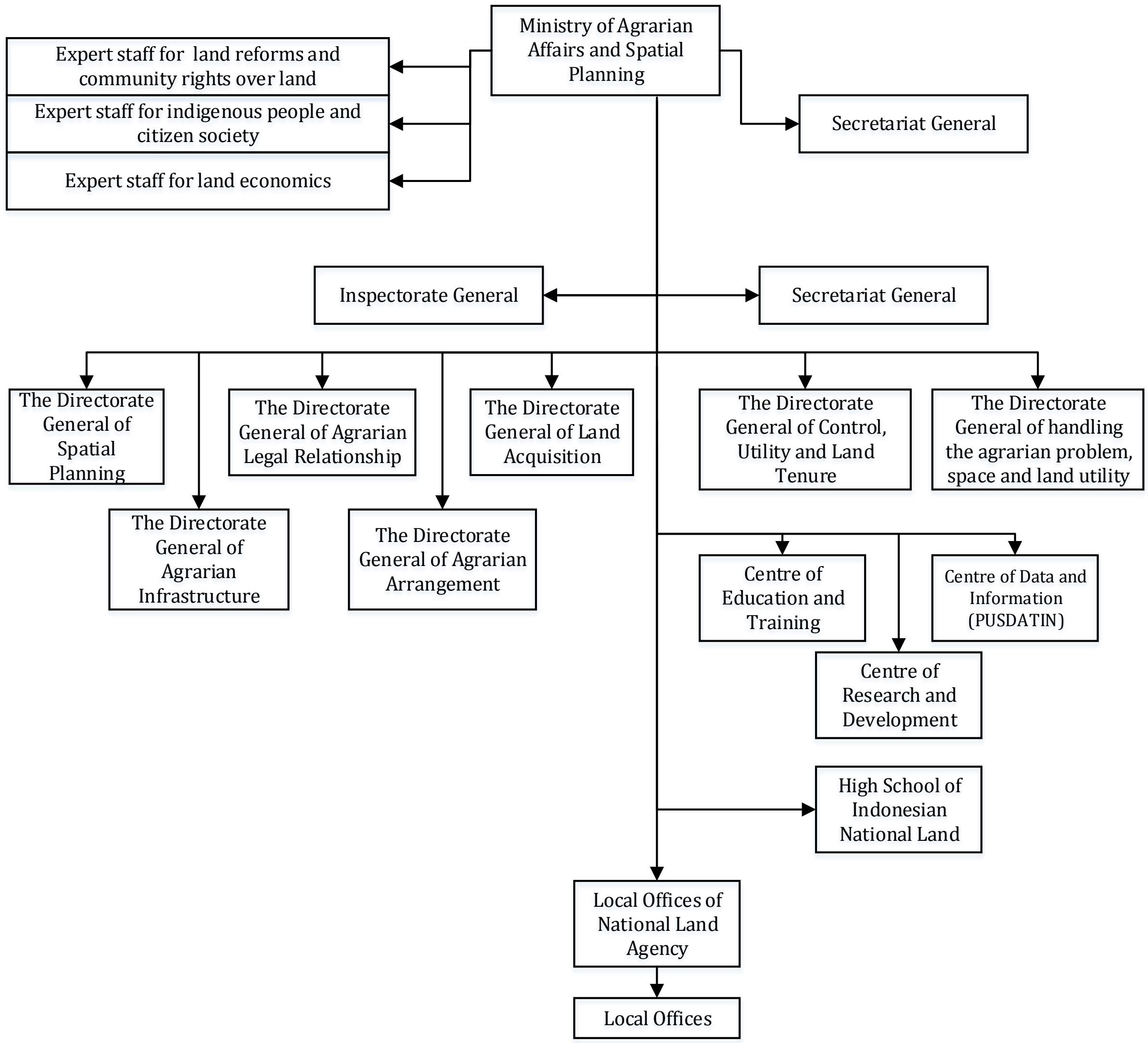
The Ministry of Agrarian Affairs and Spatial Planning, *Agraria dan Tata Ruang* (ATR) is a new Ministry in the era of President Joko Widodo established in 2015. ATR is a merger of the Directorate General of Spatial Planning, which had previously been under the Ministry of Public Works, and the National Land Agency, *Badan Pertanahan Nasional* (BPN). As a new Ministry in the Cabinet of the

President, it functions in spatial planning management as stipulated in Presidential Decree No. 17 in 2015, and the land management stipulated in Presidential Decree No.20 of 2015.

b. Spatial data usage in ATR

As a new Ministry managing land and spatial planning in Indonesia, ATR is a pioneer in large-scale spatial data and information collection (up to a scale of 1: 1000). Spatial data and information application is used for land parcels data with geographic position, land area and land ownership information.

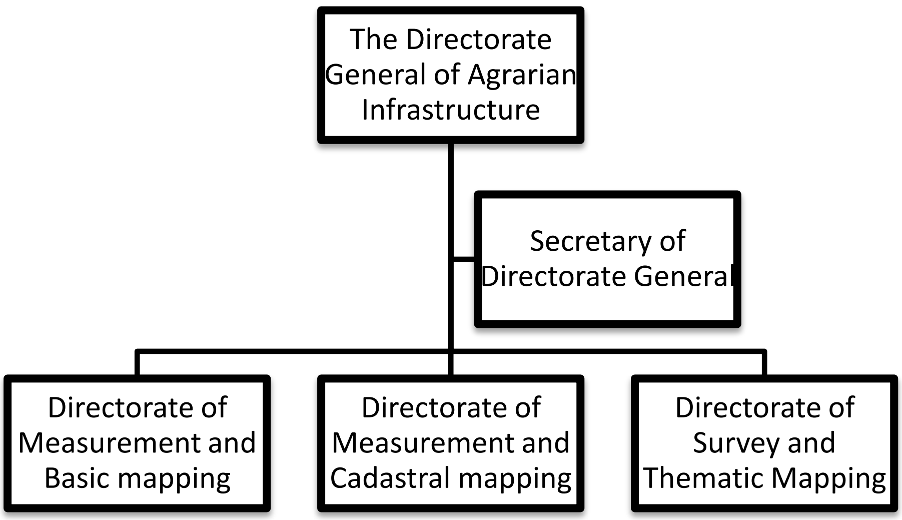
In-depth interviews with relevant officers show that spatial data and information usage to support operational activities is undertaken by the middle management of ATR. This consists of seven general directorates (see Figure 6.2), of which five general directorates utilise spatial data and information, namely the General Directorate of Spatial Planning, the General Directorate of Agrarian Infrastructure, the General Directorate of Agrarian Planning, the General Directorate of Land Acquisition, and the General Directorate of Land Use and Land Tenure. Spatial data and information storage is located in the Centre of Data and Information (PUSDATIN).



Source: http://www.bpn.go.id/Tentang-Kami/Struktur-Organisasi-Pejabat/Kementerian-Agraria-dan-Tata-Ruang-BPN (Translated by the researcher)

Figure 6.2 Organisation Structure of the Ministry of Agrarian Affairs and Spatial Planning

Specific activities of spatial data and information production and provision for land management purposes at the General Directorate level are conducted by the General Directorate of Agrarian Infrastructure. The General Directorate is divided into three directorates work units, namely the Directorate of Spatial Data and Information Provision, the Directorate of Measurements and Base Maps, the Directorate of measurement and Cadastral Mapping, and the Directorate of Surveys and Thematic Mapping (See Figure 6.3). Spatial data and information are stored in the PUSDATIN unit then utilised by other General Directorates involved with the operationalization of spatial data and information.



Source: http://www.bpn.go.id/Tentang-Kami/Struktur-Organisasi-Pejabat/Kementerian-Agraria-dan-Tata-Ruang-BPN/Direktorat-Jenderal-Infrastruktur-Keagrariaan (Translated by the researcher)

Figure 6.3 The Working Units Under The General Directorate of Agrarian Infrastructure

ATR began utilising and developing spatial data and information in the form of a Land Information System (LIS). Since the mid 1980s, the General Directorate of Agrarian Affairs (which later became BPN in 1988) has sought to use LIS in its work, starting with a few pilot projects by some officials and technicians returning from training abroad.

GIS usage had developed in data management of tenure, ownership, use and utilisation of land information, *Penguasaan, Pemilikan, Penggunaan dan Pemanfaatan Tanah* (P4T) as well as soil mapping and land parcel mapping regulated under Government Regulation No. 24 of 1997 on land registration. Some

GIS development projects were implemented during 1997 - 2002, namely Land Resources Evaluation and Planning (LREP) II and Land Use Planning and Mapping (LUPAM); specifically, the Land Information System (LIS) has implemented in some projects, such as a Land Administration Project (LAP), a Land Management and Policy Development Project (LMPDP), and a Land Office Computerization (LOC). In addition to the above programmes, the Larasita (Mobile Land Office) and Quality Control System Land Programme were innovations that prompted BPN to build information systems by utilising computer technology and information technology.

The enactment of Law no.26 of 2007 led the General Directorate of Spatial Planning, before it was merged into the ATR structure, to utilised GIS in an effort to monitor and evaluate landuse through activities / training programmes called "*Strengthening Spatial Utilization Monitoring System*" collaborating with the Japan International Cooperation Agency (JICA) from May 2007 to September 2010. The training outputs included basic and thematic spatial planning databases stored in the PUSDATIN server.

Related to spatial data and information management, the General Directorate of Spatial Planning has developed spatial plan metadata for all administrative levels in accordance with the provisions of Law No. 26 of 2007 on Spatial Planning. The metadata includes the National Spatial Plan, (RTRWN), the Specific-Island Spatial Plans (Sumatra, Java, Bali, Kalimantan, Sulawesi, Nusa Tenggara, Papua), and the National Strategic Spatial Plan (Jabodetabek and Border Kasaba) for which the metadata can be accessed through the Spatial Planning website (www.penataanruang.net/metadata).

c. Spatial Data Processing in ATR

In supporting daily operationalisation of data, ATR has representative offices in every region of the administrative hierarchy (national, province and regency / municipality). This situation has the advantage of producing accurate, up-to-date and coherent spatial data and information. The land database for spatial planning purposes is managed depending on the size of the land area.

> *"The authorisation of land measurement in ATR is divided into three levels. The measurement for the size of land areas of 0-10 hectares is performed by the officer in the regency or municipality units. The analysis of the land areas of 10-1000 hectares is carried out by the officer at the level of the provincial unit. Finally, the size of land areas of more than 1000 hectares is performed by the central office."*
>
> (ATR middle management staff : interview at 19th January 2015)

Land records were formerly stored in list forms, in paper based files, books and maps. But, because of the dynamic nature land has change, digitization of the land records is necessary. As the respondent put it:

> *"Spatial data transformation from an analogue format to digital under BPN started in 1998, with the Computerized Services Office (GeoKKP). The activity has already been running at 80% in all land offices in all regions of the country since 2009. As well as providing public on-line services land office computerization development has helped build the digital database."*
>
> (ATR middle management staff: interview at 19th January 2015)

According to the fieldwork conducted in 2015, all offices already have IT-based services. Furthermore, fieldwork interviews show that land record digitizing has been carried out through GeoKKP program (the land information book, land measurement maps and land registration maps), which includes cadastre for as much as 80% of registered land parcels.

This indicates that the human limitations to processing these data in the conventional way (paper, based mapping and calculation) have inspired creativity in the use of information technology to assist managing data. The Database system helps with the collection, compilation, and recording systems as well as efficiently utilising the computer with the aim of providing up-to-date, accessible information for various purposes.

d. Substantial issues regarding spatial data management in ATR

Spatial data and information usage have different functions in the different ATR units.

> *"At the central level, spatial data and information is used for the analysis of policy formulation and regulation of land management at the regional and local levels. At the regional level, the utilisation of spatial data is earmarked for the permissions and supervision of construction services for development that has a provincial value as set in the Provincial Spatial Plan (RTRW Provinsi). At the municipality and regency levels, spatial data is used for land procurement, use and controls of human activities, such as housing, offices, commercial and educational areas."*

(ATR middle management staff : interview at 19th January 2015)

The magnitude of the quantity and importance of land spatial data and information as a base for spatial planning and the need for high degrees of accuracy, data security, ease of dissemination of information and the effectiveness of data processing raise many spatial data management issues in the Ministry of ATR including the following:

1. Adoption of applicable international standards

   The objective of adopting international standards is to achieve standardization in accordance with globally accepted measures, with specific aspects of the land administration system in Indonesia. ATR has conducted a review of the Land Administration Domain Model (LADM) draft and inserted it into the draft of LADM country profile, especially that regarding security rights. Standardization has a significant role in considering the vision of cadastre 2034*). One of the cadastral visions is establishing cadaster at the national level which can be operated at regional and international level, and *vice versa*.

2. Use of information technology

   ATR through BPN (in the old nomenclature) has initiated the use of information technology since the Land Office Computerization Project in 1998. Since 2000, BPN has performed textual of land information and spatial data digitizing systematically and in 2002, both data began to be integrated. BPN is currently

*) The vision of Cadastre 2034 is the consensus submitted by The International Federation of Surveyors (FIG) in guaranteeing the cadastre to be worldwide integrative and shaping the future of surveying profession.

centralising the land administration system. The main reasons to centralise the system are:

- Budget Efficiency

  ATR land offices are distributed throughout Indonesian areas, starting from urban areas to the new autonomy areas. The centralised system promotes efficiency which covers hardware, software, and system maintenance especially important for remote areas.

- User friendly software and data management

  The data computer application is installed at central government level, so that a land office located at the regency and municipality levels does not need to update if there are changes to the application. The changes are often caused by several factors, such as database upgrades, changes in regulations or application errors.

- Access to land information

  Within the centralised computer applications, land records from all regency and municipality land offices are stored in a single national land database. Searching information by the registered land number, the owner, the value of land transactions, wastelands, land in dispute, the value of security rights and others categories can be conducted quickly at all levels and between agencies.

- Data security

  The natural disasters which often occur in several regions of Indonesia, such as fires can result in damaged or lost physical and electronic data. A centralised system makes it easier to perform data backup for all of the land offices. But at the same time, the centralised database has also needs to be backed up to anticipate possible disasters that may affect it.

3. Challenges

The land records system under ATR management today is nearly complete so that the application can serve the needs of internal management-level data from the Land Office, Regional Office and Headquarters. A portfolio data integration application is being developed as for ATR and is being computerised through the development of two strategic programs: the National Land Management Information Systems (SIMTANAS), and the Administration Integrated Management Information System (SIMPADU). Both of these strategic programs will refer centralised architecture and hardware-app systems.

The next application development is the Web 2.0 (The second phase of web development that characterized by communication and collaboration with web provider and users through social media dialogue in a virtual community (DiNucci, 1999)) for public use, through which two-way communications between citizens and ATR can be conducted. In addition, Web 2.0 is developed to improve the transparency of public services in the e-government framework, improving the accuracy of land records, and increasing public confidence in the citizen and national assets management.

Some online land services which will be put into the public arena include: the land registration service; information on land parcel registration following objections (if any); community-based mapping; certificates checks and other special services for parties concerned with land records, such as the land titles registrar (PPAT), banks, and other government agencies.

The centralised architecture of the land development system requires adequate Internet communications and security network availability. In this context the responsible bodies are the Ministry of Communication and Information (Menkominfo) alongside telecommunications service providers supplying communication infrastructure with sufficient bandwidth throughout Indonesia.

4. The National Geospatial Information Network (JIGN)

By issuing Presidential Regulation No. 27 of 2014 concerning the National Geospatial Information Network (JIGN) and Presidential Regulation No. 9 in 2016 on accelerating the implementation of the One Map Policy at 1: 50,000 map scale, ATR has emerged one of the custodians of JIGN. To support JIGN, ATR has disseminated spatial data and information:

1. Thematic maps (Land use maps for regency (1:50,000) and municipality (1:25,000) scales), land use maps in particular areas, the structure spatial plan maps, the land use plan maps. All spatial data can be accessed by public in uneditable format (JPEG).
2. Cadastral maps, engineering base maps, land base maps, land registration maps, but still restricted access between government institutions only.
3. The National Cadastral Framework (KDSN).

6.4.2 Spatial data and information management in the Ministry of National Development Planning

a. Introduction

The Ministry of National Development Planning / National Development and Planning Board, *Badan Perencanaan dan Pembangunan Nasional* (BAPPENAS) is one of the Ministries that has existed since Indonesian independence in 1945. BAPPENAS has a role in coordinating, making priorities, monitoring and evaluating national development and planning.

BAPPENAS has the task of formulating the Indonesian development vision and mission for inclusion in the National Development Plan (which includes Long-Term (20 years), Medium-Term (five years) and Short-Term (annual) Development Plans), and evaluate its implementation. To ensure optimal preparation of the development plan and has mutual synergy with Indonesian development at all level, BAPPENAS provides guidance and supervision for the spatial plans formulated at province, regency and municipality government levels.

b. Spatial data usage in BAPPENAS

In general, BAPPENAS is not responsible for creating spatial data. The spatial data and information demands of BAPPENAS rely on the informal requests of the deputies who interact with spatial data in institutional sectoral Ministries and other government institutions producing spatial data, such as the Ministry of Agrarian Affirs and Spatial Planning (ATR), the Ministry of Public Works, the Ministry of Transportation, the National Mapping Agency (BIG), and the National Aeronautics and Space Agency (LAPAN). This is supported in an interview with a middle management staff of BAPPENAS

> *"BAPPENAS does not produce data, but collects data and information from various Ministries and central government agencies. But BAPPENAS has collaborated with the Indonesian Central Bureau of Statistic (BPS) and there is a Memorandum of Understanding (MoU), between Bappenas and BPS according to which the Bureau of Statistics data will be processed in BAPPENAS then disseminated to each Ministry or government agency that request it."*

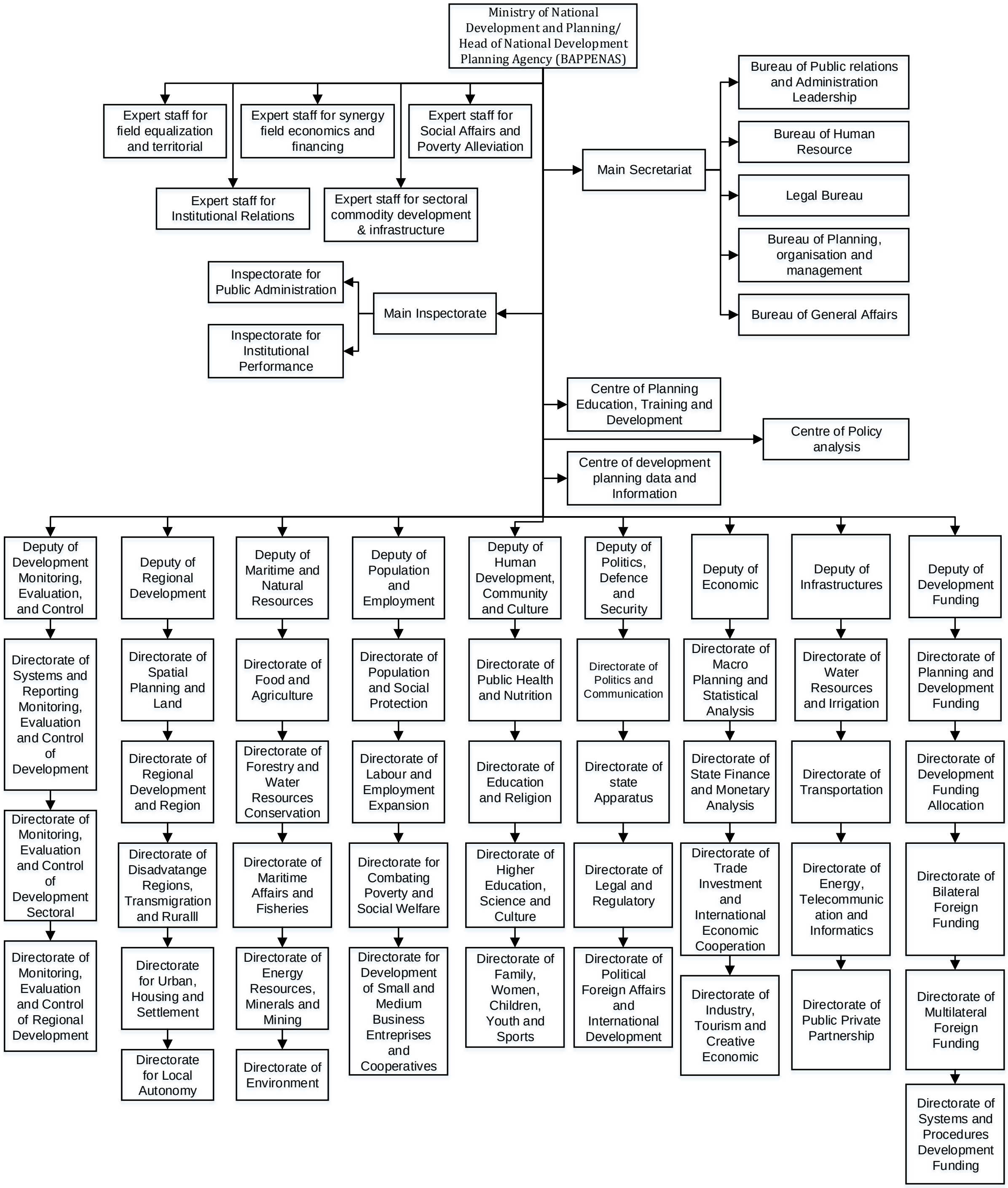
(BAPPENAS middle management staff: interview at 5th February 2015)

Even though the main duty of BAPPENAS is not to create spatial data, some deputies and directorates under BAPPENAS use spatial data for development planning analysis. According to the interview of Senior Management Staff no.1 conducted during the period of January-March 2015, spatial data in BAPPENAS is utilised by four deputies.

> *"Spatial data usage in BAPPENAS is utilised by namely the Deputy of Development Monitoring, Evaluation and Control; Deputy of Regional Development; Deputy of Maritime and Natural Resources; and Deputy of Infrastructures. Furthermore, specific job desk for spatial data sharing in BAPPENAS handle by Deputy of regional development with specific working unit is sub-directorate regional data and information under Directorate of regional development and region."*

(BAPPENAS Senior management staff No.1: interview at 5th February 2015)

BAPPENAS organisational structure working units can be seen in Figure 6.4.



Source: http://www.bappenas.go.id/id/profil-bappenas/chart-struktur-organisasi/ (Translated by the researcher)

Figure 6.4 Organisational structure of BAPPENAS

As already mentioned, BAPPENAS has the task of formulating the Indonesian development vision and mission for inclusion in the National Development Plan. The programmes are typically varied according to activity reports, whether it is proposal, mid-interim progress report, or the final report utilising spatial data and information. This kind of information is used to support the analysis of analogue format or hardcopy at different scales. Therefore, the evaluation of development projects is complicated and encounters difficulties in spatial analysis, storage and recall of spatial data and information.

In general, BAPPENAS has limited spatial data management performance. The observations from the five NSDI pillars (data, human resources, technology, organisation, law) indicate: limited spatial data usage; limited staff skills in understanding and operating geospatial information applications; limited technology to support spatial data and information storage and management in software and hardware; and the lack of data and information integration amongst work units and regulation in the Ministry.

The low performance of spatial data usage in BAPPENAS is highlighted in an internal report by the Indonesian Infrastructure Iniative (INDII) in 2010. It revealed that although BAPPENAS is a government institution which in charge of analysing and integrating data and information related to spatial contexts, it used less spatial data and information for GIS compared to other government agencies. The appraisal of GIS performance in the central Indonesian government departments can be seen in Table 6.3

Table 6.3 GIS Use and Capabilities of Selected Government Agencies

Government of Indonesian Departments	GIS Use	GIS Capability
Ministry of Transport	Medium	Intermediate
Ministry of Public Works (PU)	Medium	Intermediate
National Electricity Company (PLN)	Medium	Intermediate
Ministry of Energy & Minerals (ESDM)	Medium	Intermediate

BIG	Extensive	Intermediate/Advance
Central Bureau of Statistics (BPS)	Low	Low
Bappenas	Low	Low

Source: INDII (2010, pp.4)

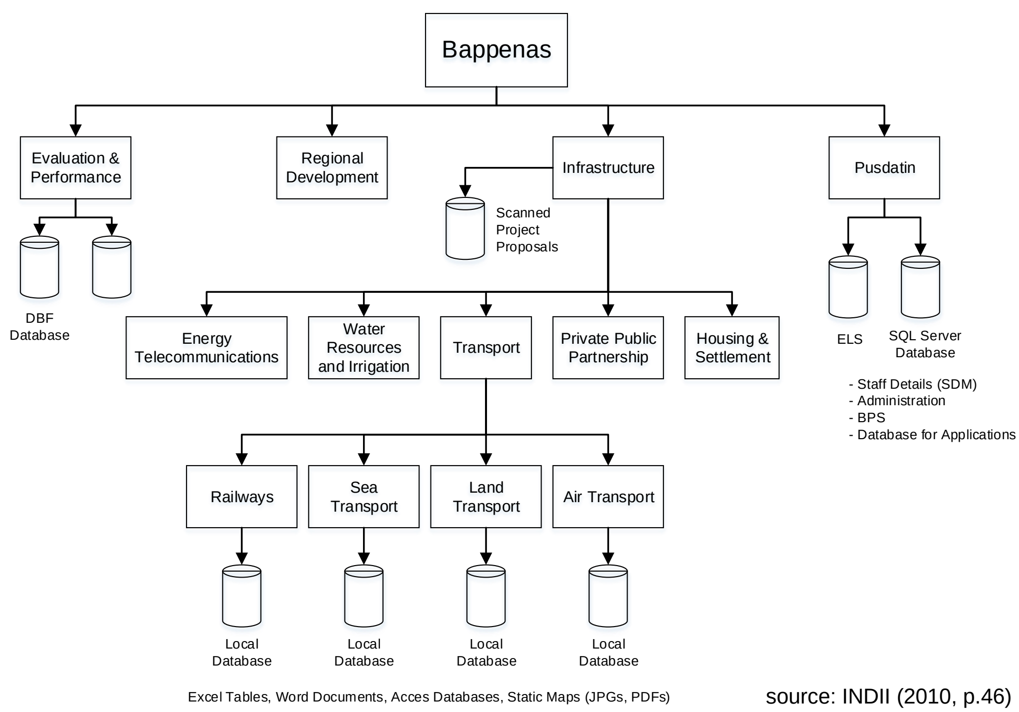
c. Spatial Data Processing in BAPPENAS

Information gathered in fieldwork confirms the poor spatial data management performance face to BAPPENAS. The situation is summarised in this interview with a member of middle management staff at BAPPENAS.

> *"In BAPPENAS itself, there are many data related to the regional development theme. However, most of them are stored in their respective working units. Thus, this situation becomes a primary constraint, when working between units internal to BAPPENAS. And when the public wants to collect data related to planning and development in particular areas, it takes a long time, because of the bureaucracy involved, from the General Directorate to the particular interest Directorate."*

(BAPPENAS middle management staff : interview at 5th February 2015)

These points raised in interview is also supported by a study by INDII (2010) (See Figure 6.5).



source: INDII (2010, p.46)

Figure 6.5 Current Data Storage in BAPPENAS

Figure 6.5 shows the complexity of the organisational unit at the deputy level, and the sub-directorate within BAPPENAS in relation to collecting, storing and managing relevant data, which can lead to data conflicts, such as data silos. Difficult of access to data and information occurrs between all levels and between trans-vertical, trans- horizontal and trans-sectoral units.

General information about spatial data analysis usage experiences in BAPPENAS were based on some employees in certain working units, who had knowledge of GIS or experience of collaboration with external government agencies for GIS application developments. Unfortunately, GIS development has been undertaken by particular working units and database have been created in isolated 'silos', and have not been integrated with other working units in the internal organisational structure of the Ministry.

d. Substantial issues regarding spatial data management in BAPPENAS

BAPPENAS is a Ministry with the duty to utilise and manage comprehensive data development in spatial plans. Unfortunately, there is less attention to spatial data and information usage. The development of GIS in the working unit of the Ministry is stored in data 'silos'. This has led to the ineffectiveness of data sharing and has resulted in duplication.

Interviews with two senior management and one middle management staff members indicated that spatial data development and sharing was often difficult to implement. Several issues were highlighted during interviews:

1. *"To perform spatial data sharing, there must be a functional career (Jabatan fungsional) of spatial data operator and manager under the Indonesian government career system to take care of spatial data management. And there are urgent needs to maintain and control spatial data quality."*

   *(*BAPPENAS Senior Management Staff No.1: interview at 5th February 2015*)*

2. *"During early development of internet infrastructure in Indonesia, the amount of bandwidth ranged from 3Mbps to 5Mbps. We have already reached 10Mbps (and even then not stable in 10Mbps, sometimes goes down). This capacity is still not enough for implementing data sharing*

operations, because, uploading and downloading large amounts of spatial data using large memory capacity is affected by the low speed and is time consuming. And, sometimes, if fails and there has to be repeated uploading or downloading data."

*(*BAPPENAS Senior Management Staff No. 2: Interview at 5th February 2015*)*

3. *"The main obstacle is the character or nature of the individuals or the institutions to be against open and sharing. Until now, most people take the attitude that the data or information are commodities or goods that have value. If the data or information has entered the public domain, then the commodity had no value. Various bureaucratic regulatory barriers were put in place by individuals and institutions unwilling to share data."*

*(*BAPPENAS Senior Management Staff No. 2: interview at 5th February 2015*)*

4. *"In BAPPENAS itself, there are many data related to the regional development theme. However, most of them are stored in their respective working units..."*

(BAPPENAS middle management staff; interview at 5th February 2015)

In summary of interviews, spatial data sharing issues facing BAPPENAS can be summarized as follows:

- Lack of human resources;
- Lack of network technology;
- Nature of instiutions not favourable to open data;
- Various regulatory and bureaucratic barriers.

To drive spatial data management, particularly spatial data development and sharing, BAPPENAS has taken some action, for example, implementing a solution to broaden corporate spatial information sharing by:

- Achieving consensus amongst internal organisational units (Deputies, directorates and subdirectorates) related to spatial data development and sharing;
- Centralizing the data and information system to give access to all internal organisational units through a single point;
- Eliminating data duplication and data 'silos';
- Improving reports by developing quick and effective responses.

6.4.3 Spatial data and information management in Ministry of Marine Affairs and Fisheries

a. Introduction

The Indonesian Ministry of Marine Affairs and Fisheries, *Kementerian Kelautan dan Perikanan* (KKP) is a relatively new government agency which was formed in 1999. The Ministry was established under President Abdurrahman Wahid's cabinet through Presidential Decree No. 355 / M of 1999.

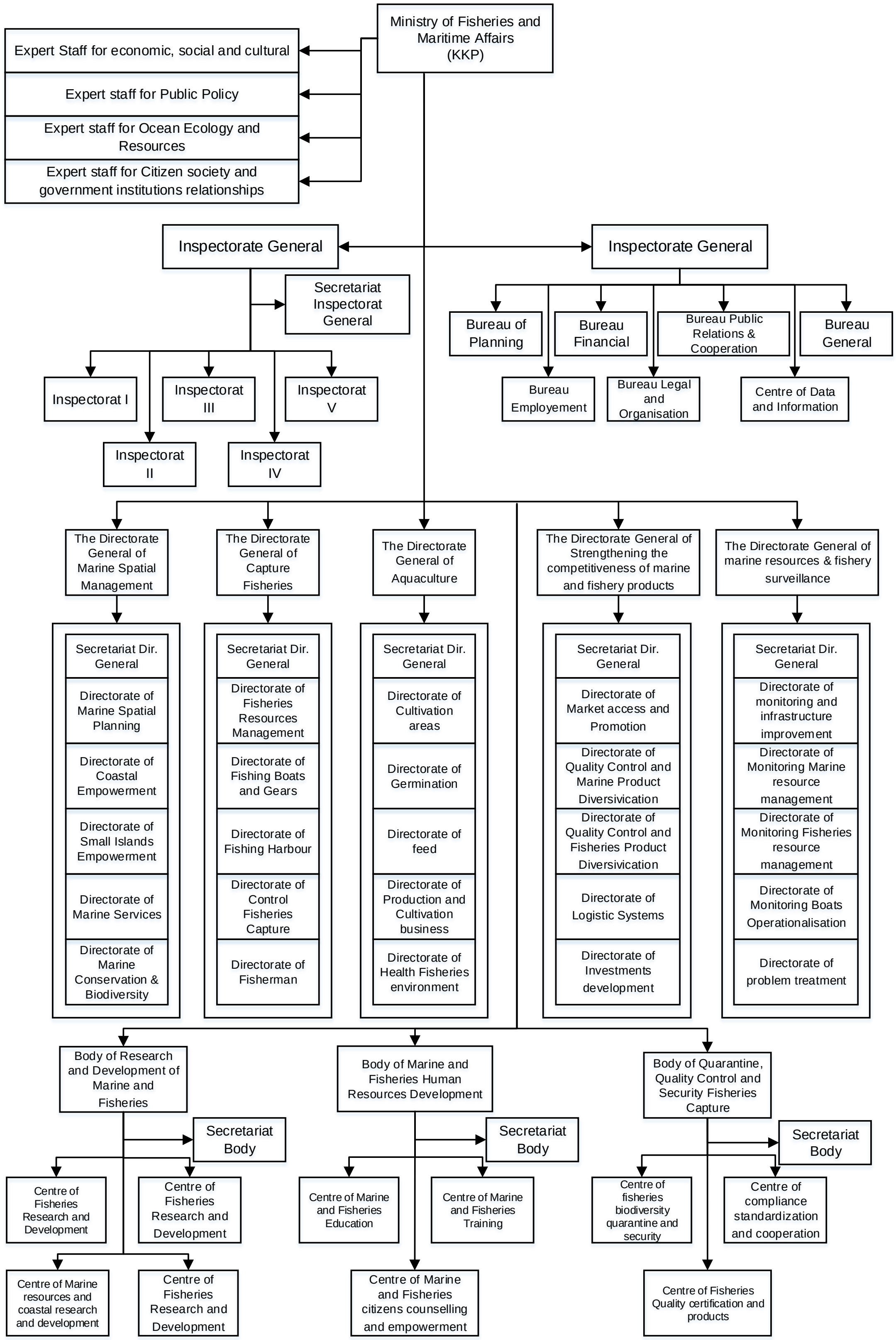
In terms of the spatial planning context, KKP is responsible for planning, monitoring and evaluation of Indonesian marine spatial planning, known as the Zoning Plan for Coastal Areas and Small Islands, *Rencana Zonasi Wilayah Pesisir dan Pulau-Pulau Kecil* (RZWP3K). Information from interviews indicates that the difference between spatial planning management in the Ministry of Marine Affairs and Fisheries and in the Ministry of Agrarian Affairs and Spatial Planning is the arrangement of their authority areas.

Spatial planning management from coastline to mainland is managed by Ministry of Agrarian Affairs and Spatial Planning, while spatial planning management from coastlines to the Exclusive Economic Zone (ZEE) including Indonesian sea sovereignty is managed by the Ministry of Marine Affairs and Fisheries. In daily operationalisation marine resources and marine spatial planning are hard to manage through human's naked eyes, therefore, the situation needs support devices that be equiped with spatial data and information usage.

b. Spatial data usage in KKP for Spatial Planning Purposes

Based on interview with one of middle management staff, it appears that almost all general directorates and working units under KKP have been using spatial data and information, with the exception of the Human Resource Development and Fisheries units.

The Generals Directorate and bodies under KKP working units that utilise spatial data are: the General Directorate of Capture Fisheries; the General Directorate of Aquaculture; the General Directorate of Processing and Marketing of Fishery; the General Directorate of Marine, Coastal and Small Islands; the General Directorate of Marine Resources and Disheries; the National Research and Development of the Marine and Fisheries body; and Fish Quarantine, Quality Control and Safety of Fishery bodies (See Figure 6.6).

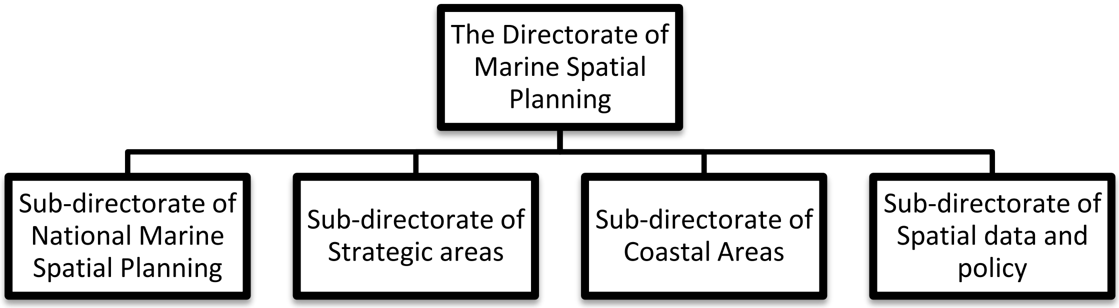


Source: http://kkp.go.id/2016/07/24/struktur-organisasi-kementerian-kelautan-dan-perikanan/

(Translated by the researcher)

Figure 6.6 Organisational Structure of KKP

In terms of spatial planning, the work unit that handles Indonesian marine spatial planning in KKP is the Directorate of Marine Spatial Planning under the General Directorate of Marine Spatial Management. In addition, spatial data and information production and management for the marine spatial planning context are handled by a special unit called Sub-Directorate of spatial data and policy (See Figure 6.7)



Source: http://www.djprl.kkp.go.id/profil-direktorat-jenderal-pengelolaan-ruang-laut (Translated by the researcher)

Figure 6.7 The Working Units Under Directorate Marine Spatial Planning, Coastal and Small Islands

Spatial data management in the Sub-Directorate of Spatial Data and Policy is differentiated into the spatial information section that contains spatial data and information on the existing conditions of the sea; and the spatial evaluation section that contains spatial data and information on the results of marine spatial management evaluations. All data and information produced by both sections are stored in KKP Geo-portal which is collected in the PUSDATIN unit (Centre of Data and Information).

Spatial data and information application under KKP is generally divided into basic data and thematic data groups. The classification of basic spatial data under the Ministry can be described as follows:

1. Basic terrestrial data include:
   - Contour
   - Bathymetry
   - Geology
   - Ocean Geomorphology
   - Coastline
   - National Road Networks

2. Oceanographic data include:
   • Flow
   • Tides
   • Waves
   • Water quality
   • Ocean animal and plant lists
3. Boundaries
   • Boundary of the continent
   • Boundary of the national state
   • Boundaries of Provinces
   • Boundaries by territories

The classification of thematic spatial data by the working unit under the Ministry of Marine Affairs and Fisheries can be described as follows:

1. Coastal ecosystems and fish resources data:
   • Coastal ecosystems data (coral reefs, mangroves, seagrass)
   • Fish species and abundance Data
2. Existing sea region usage Data:
   • Fisheries aquaculture
   • Capture fisheries
   • Tourism
   • Mining
   • Ports
   • Route of cruises
   • Routes of marine biota
   • Conservation areas
3. Utility data
   • Water network
   • Province and local road network
   • Electric network
4. Disaster risk and pollution data
   • The type of disaster
   • Location coordinates of disaster
   • Area affected by disaster
   • Extent of damage
   • The level of catastrophe losses
   • The source and location of pollution

Details of basic and thematic spatial data usage under the General Directorate of Marine, Coastal and Small Islands can be seen in Appendix B.

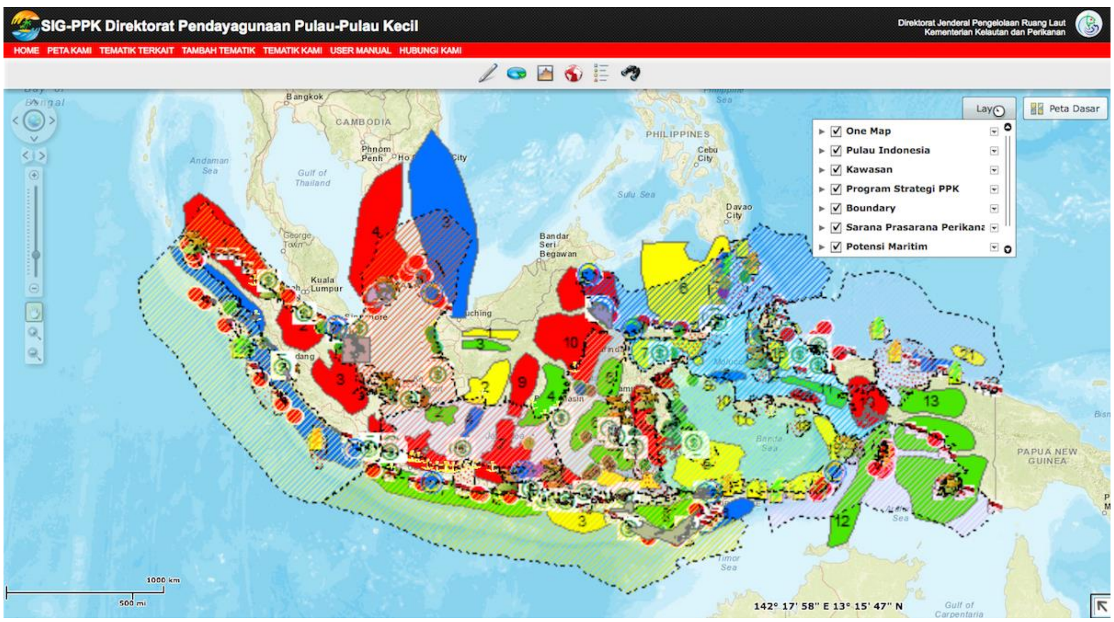
c. Spatial Data Processing in KKP for Spatial Planning Purposes

Spatial data management for spatial planning in KKP began in the period 2003-2004.

> *"Within the scope of KKP, which only began to develop around the year 2003/2004, the spatial planning unit has been included in those units initiated to build and maintain the marine spatial data."*

(KKP Middle management Staff: interview at 12th March 2015)

One of the spatial data and information management outputs for spatial planning activities was to build up a small islands database as part of a national programme called the Small Islands Expeditions for Marine Resource Inventories stored at the portal http://www.ppk-kp3k.kkp.go.id/giskkp/ (See Figure 6.8).



Source: http://www.ppk-kp3k.kkp.go.id/giskkp/

Figure 6.8 Webgis of Small Islands Database

Currently, spatial data and information management for coastal and marine spatial planning is regulated under Law No. 1 of 2014 as an amendment of Law No. 27 of 2007 in the context of the Zoning Plan for Coastal Areas and Small Islands (RZWP3K). One role of spatial data and information usage in RZWP3K is the determination of use allocation for coastal areas and small islands.

d. Substantial issues regarding spatial data management in KKP for spatial planning purposes

In-depth Interview with one of middle management staff of KKP indicate that spatial data development and sharing was often difficult. Several issues were highlighted during interviews:

1. *“Actually, we easily got permission to initiate open data between working units; the motivation is to achieve one vision or one main goal of the Ministry. However, due to different political commitments, eventually, data sharing could not be implemented. Here, it can be taken that the leadership commitment has the strong role, but it is very difficult to implement.”*

   (KKP Middle management Staff: interview at 12th March 2015)

2. *“None of the KKP working units are allowed to upload data without permission from higher officials at the level of Ministries. The problem is that the KKP has not prepared a data sharing procedure. Therefore, spatial data sharing cannot operate yet.”*

   (KKP Middle management Staff: interview at 12th March 2015)

3. *“The obstacles to spatial data sharing in KKP is that the spatial data sharing concept is unclear as to how the data sharing mechanism would work, what type of data can be shared and who is collecting the data. In other words, the coastal and marine data sharing protocol in KKP itself is still not firm.”*

   (KKP Middle management Staff: interview at 12th March 2015)

4. *“Admittedly the implementation of government programmes in Indonesia is moving in one direction [Top-Down]. [For Instance] information on stranded marine mammals; the lowest KKP working units find information about stranded marine mammals for themselves, such as through local media, and then toke to the field for verification. [But] in practice, community participation in providing data and information is still lacking. If communication can be delivered on both sides [government and citizens], this could be a check and balancing. The system does a good job, actually, where collaboration between government and communities [takes places], which brings together top-down with bottom-up approaches [and this can] provide added value to create a democratic atmosphere and trust between stakeholders to achieve prosperous development.”*

   (KKP Middle management Staff: interview at 12th March 2015)

Based on field observations, spatial data management performance by the working units under KKP seems to be constructed individually by each General Directorate and Directorate. In other words, spatial data and information is built in separated data silos. As a result, data and information are not integrated with other work units in the internal organisational structure of the Ministry.

In general, strategic issues related to spatial data management under KKP are:

1. The complexity of small islands management problems and lack of coastal and marine ecosystems pollution and damage control;
2. Lack of marine spatial plans, particularly in local governments, which has raised issues on limited data and spatial information regarding local marine condition;
3. Lack of a spatial data integration;
4. Inadequacy of information systems related to marine spatial planning and monitoring;
5. Lack of the institutional communication and coordination between central and local government levels;
6. Lack of data sharing protocol in the Ministry of Marine Affairs and Fisheries.

6.4.4. Spatial data and information management in Indonesian Mapping Agency (BIG) for spatial planning purposes

a. Introduction

The pioneer of Indonesian mapping agency has been initiated since 1938. When Indonesia gained independence in 1945, surveys and mapping were conducted sporadically by various Indonesian parties (government, private companies and academics) with the coordination of an *ad hoc* institution named the Command Survey and Mapping, *Koordinator Survey dan Pemetaan Nasional* (Kosurtanal) and the Board of Survey and Mapping, *Dewan Survey dan Pemetaan Nasional* (Desurtanal) which aimed to map natural resources throughout Indonesian territory.

In terms of surveying and mapping activities in Indonesia, the Indonesian National Mapping Agency experienced a change in nomenclature and organisational structure and survey and mapping of the sovereign Indonesian territory were undertaken. The production of data and geographic information led to overlapping activities and duplication of surveying and mapping productions, thus in 1969, officials of Kosurtanal and Desurtanal proposed the establishment of one official national survey and mapping agency, namely the National Survey and Mapping Coordinating Agenct (BAKOSURTANAL). This aimed to achieve efficiency and financial savings related to spatial data and information production and provision.

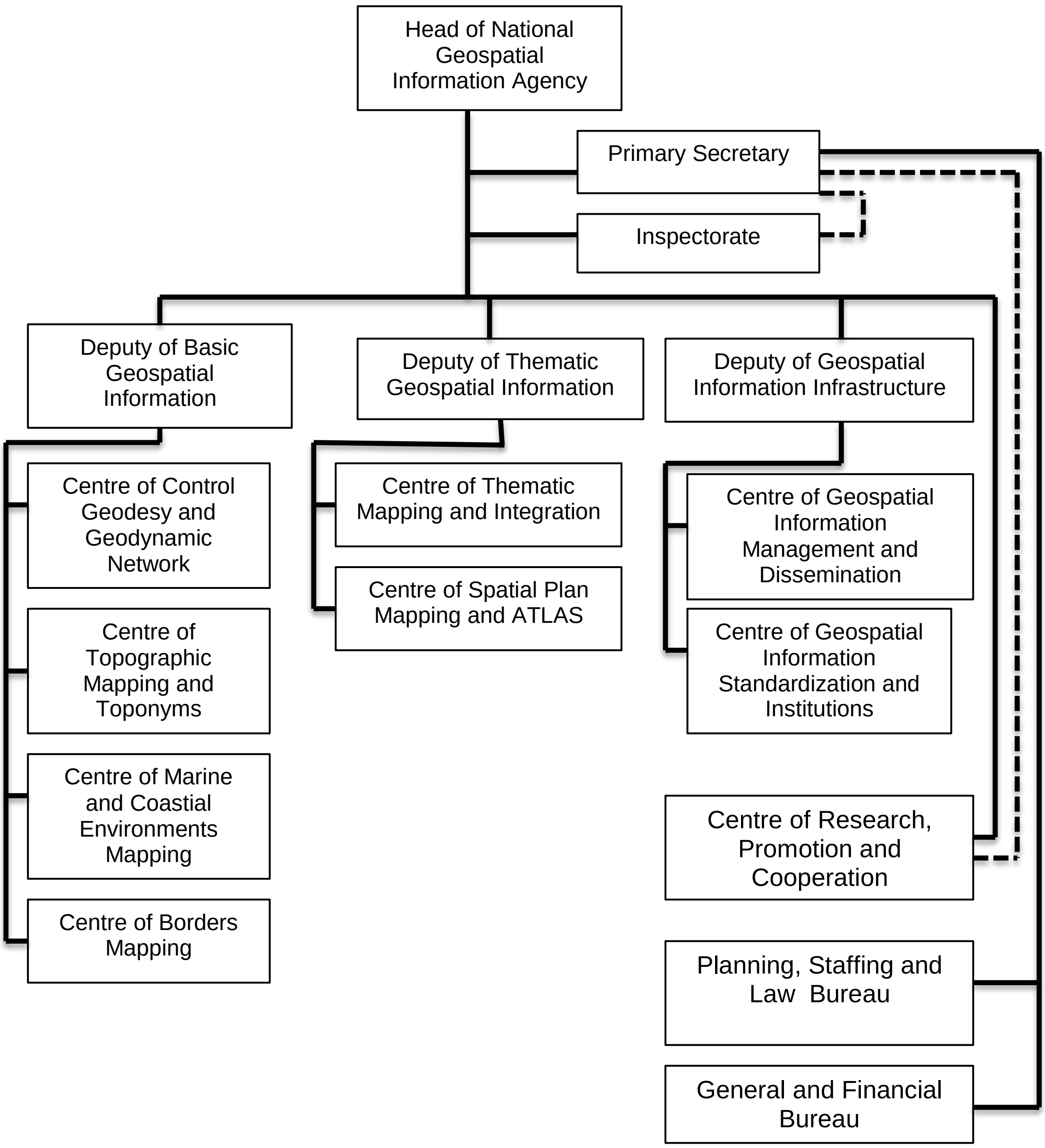
Since the promulgation of Law No. 4 of 2011 of Geospatial Information, spatial data and information management has changed in Indonesia, followed by changes to nomenclature and organisational responsibilities from BAKORSURTANAL to *Badan Informasi Geospasial* (BIG) under Presidential Regulation No. 94 of 2011 regarding BIG.

Presidential Decree No. 94 of 2011 outlines that BIG is coordinated by the Minister of Research and Technology for carrying out its duties and functions, but in the period 2014-2019, BIG's tasks and functions were moved to coordination by the Ministry of National Development Planning, stipulated in Presidential Decree No. 127 of 2015. This change aimed to optimize the supply, management and usage of geospatial information in supporting national development and planning policies and regulations.

b. Spatial data usage in BIG for Spatial Planning Purposes

Information about spatial data usage in BIG has been gained from interviews with senior and middle management staffs as well as observations in several of BIG's work units. In the performing of national tasks regarding spatial data production and provisions, BIG has three deputies, namely the Deputy of the Basic Geospatial Information (IGD), the Deputy of Thematic Geospatial Information (IGT) and the Deputy of Geospatial Information Infrastructure (IIG). In terms of spatial data and information usage for spatial planning purposes, there is a special unit called the

Centre for Spatial Mapping and ATLAS, while the National Spatial Data Infrastructure, data management is handled by the Deputy of Geospatial Information Infrastructure (See Figure 6.9)



Source: http://www.bakosurtanal.go.id/organisasi/

Figure 6.9 BIG Internal Organisational Structure

As an official government agency in charge of spatial data production, BIG produces two types of spatial data: basic and thematic. The foundational aspects in creating basic spatial data are stipulated in Law. No.4 of 2011:

1. Geodetic Control Network set out in Articles 8,9 and 10 include:
   a. Horizontal Control Network;
   b. Vertical Control Network;
   c. Gravity Control Network

The purpose of determining Horizontal Control Network and Vertical Control Network is monitoring the dynamics of the earth's crust. The gravity control network is used to monitor the gravity area – the Sphere elevation reference.

2. A Basic Map set out in Article 7 of Law No.4 of 2011 includes:

a. The Indonesian *Rupabumi* Map;

b. Map of Indonesian Coastal Environments (LPI);

c. Map of National Marine Environment (LLN)

The thematic spatial databases produced by BIG are:

1. Geomorphology
2. Land Cover
3. Wetlands
4. Conservation Area
5. Potential Protected Areas
6. Ecosystem
7. Critical Areas
8. Disaster Risk
9. Balance of Land Resources
10. Balance of Water Resources
11. Balance of Forest Resources
12. Balance of Mineral Resources
13. Watersheds

Details of thematic spatial database provided by BIG can be seen in Appendix C.

c. Spatial Data Processing in BIG for Spatial Planning Purposes

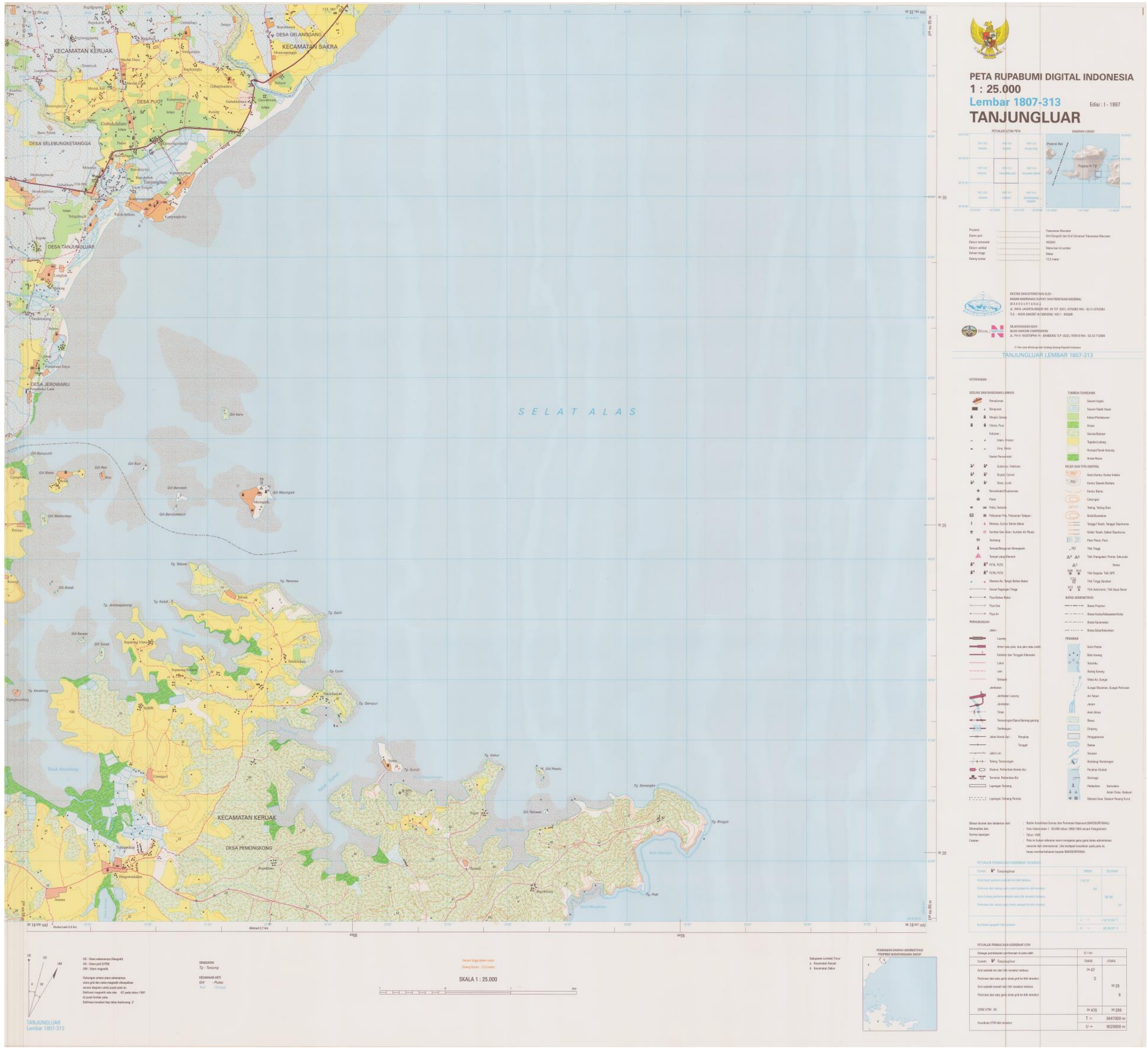
As the official state institution whose task is producing spatial data, BIG has supported the implementation of the Indonesian planning and development agenda through the existing natural resources inventory in Indonesia. As already explained in the previous section, basic spatial data and information produced by BIG are the Indonesian *Rupabumi* Map (RBI), the Indonesian Coastal Environment Map (LPI) and the National Marine Environment Map (LLN). This section will examine the role of the three basic maps in the planning and development process.

1. The use of RBI Map as the basis for spatial plan maps

The Indonesian RBI map is not only produced at small and medium map scales (1: 1,000,000 to 1: 25,000), but also on large maps at scales of 1: 10,000, 1: 5,000, 1: 2,500 and 1: 1,000. In terms of the preparation of spatial planning in Indonesia, the activities of spatial planning are carried out at the national, province and municipality/regency levels (see Chapter 5).

Spatial Planning Law set out in Law No.26 of 2007 requires the preparation of the Spatial Plan to include spatial structure and land use plan maps as a condition for approval by the Legislature to become guidance for the government to carry out their programmes. The focus of the relationship between BIG outputs and the spatial planning process is the RBI map which becomes the basis for preparing a spatial structure and land use plan maps.

The RBI map at 1: 1,000,000 scale is used to develop the spatial structure and land use plan maps in the National Spatial Plan, while, the RBI map at 1: 250,000 scale is used to prepare the spatial structure and land use plan maps in the Provincial Spatial Plan. The RBI maps with at scales of 1: 50,000 and 1: 25,000 / 1: 10,000 are used as the basis for the preparation of the spatial structure and land use plan maps at the level of regency and municipality level respectively.



Source: BIG (1997) with permission to re-print from BIG

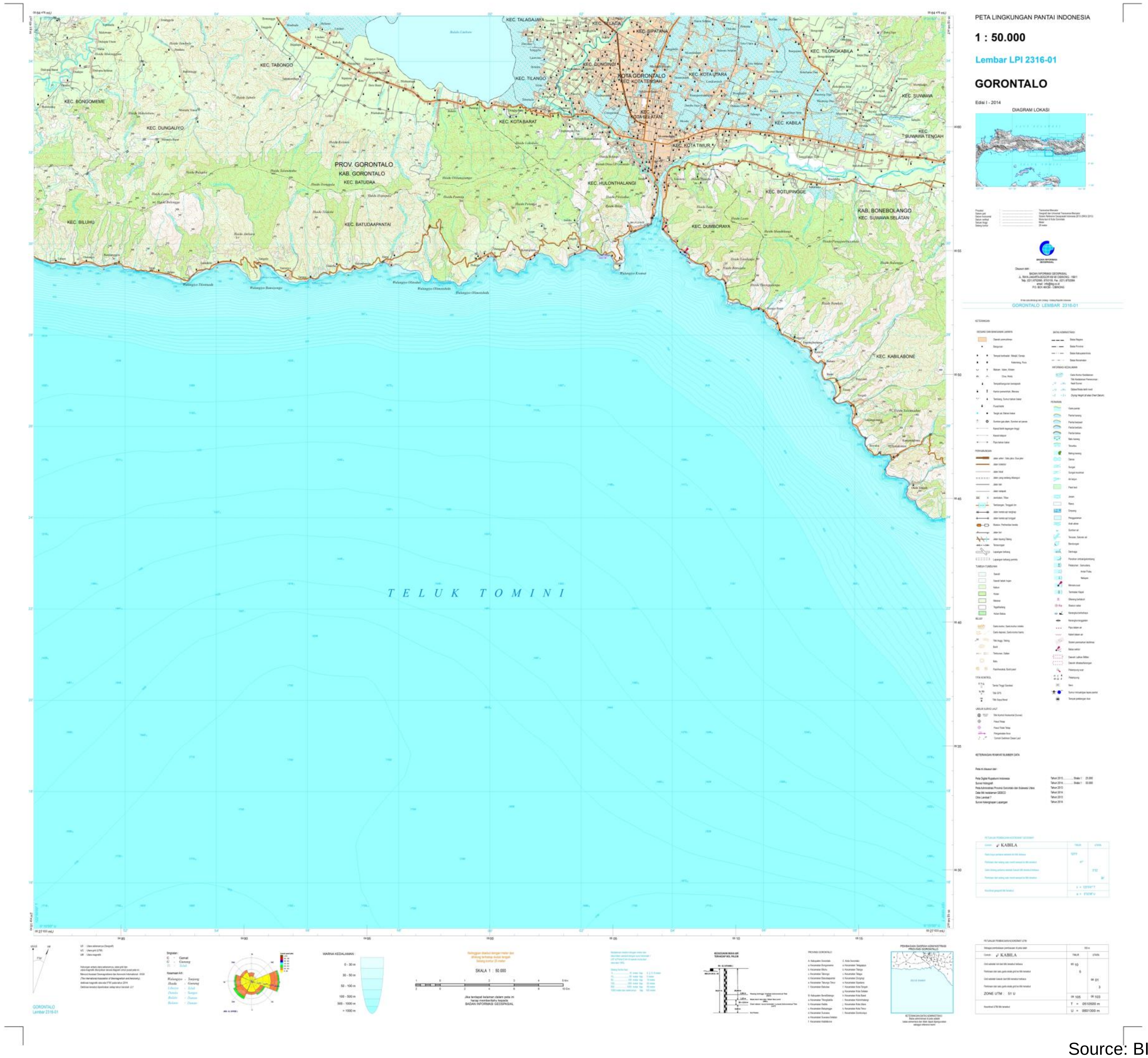
Figure 6.10 Example of *Rupabumi* Indonesia Map Scale 1:25,000

However, BIG still has problems supplying spatial data in large-scale maps of 1: 10,000, 1: 5,000, 1: 2,500 and 1: 1,000 and not all regions throughout Indonesia are covered. Law No.26 of 2007, Article 14 Paragraph 3 Letter c states that the Indonesian RBI large-scale maps are required for preparing the Detailed Spatial Plans, *Rencana Detail Tata Ruang* (RDTR) for Regency, Municipality and Strategic District Areas.

The effect of the absence of large-scale spatial data base maps is a delayed enactment of RDTR. Currently, a temporary solution is to support third parties in each regency or municipality to make large-scale spatial data base maps facilitated by BIG supervisions.

2. The Indonesian Coastal Environments Map (LPI) for Coastal / Beach Regional Plans

LPI spatial data production in digital format is one of BIG's tasks in the procurement of basic spatial data for sustainable national development in marine sector, especially coastal / beach areas that have natural resources to be explored for the benefit and well-being of coastal communities. LPI base map is a combination of the *Rupabumi* Map (topographical map) with a sea map presented in a single projection system and used as a base map to create thematic maps in coastal areas (See Figure 6.11). One of the benefits of the LPI map is that it supports provincial, regency and municipality governments in spatial planning, coastal zoning, disaster mitigation, and other infrastructure development planning formulations.



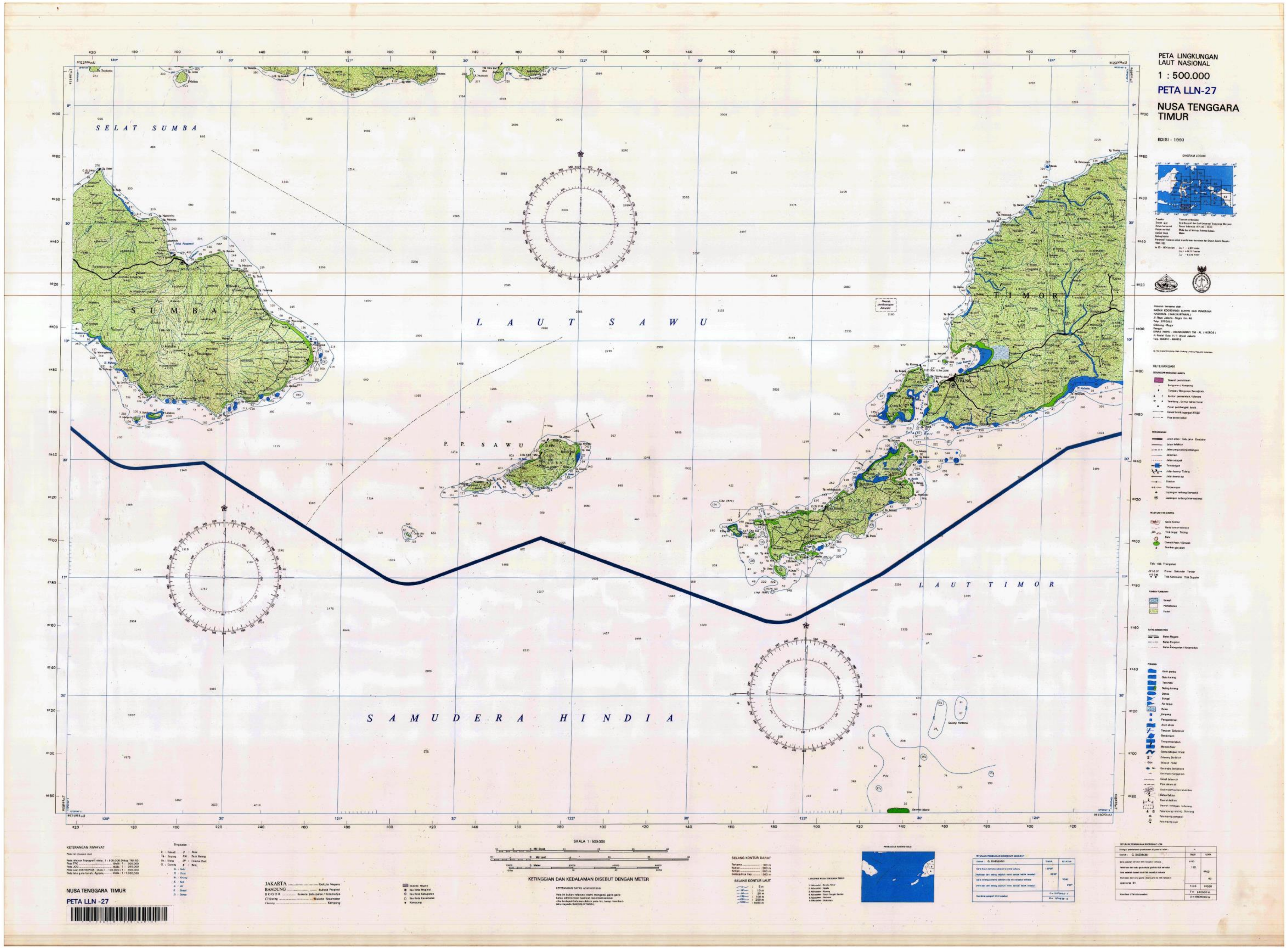
Source: BIG (2014) with permission to re-print from BIG

Figure 6.11 Example of The Indonesian Coastal Environments Map (LPI)

Law No. 4 of 2011 Article 18, paragraph 2, stipulates that the LPI maps should be produced at scales of 1: 250,000, 1: 50,000, 1: 25,000 and 1: 10,000. In the 2013 BIG report It was revealed that LPI maps have been produced in 54 Map Sheet Numbers, *Nomor Lembar Peta* (NLP). They consist of a 10 numbers map scale of 1: 250,000 in the northern and central Sulawesi; a 40 numbers map scale of 1: 50.000 in the coastal areas of West Kalimantan, Central Kalimantan and South Kalimantan; and a 4 numbers map scale of 1: 25,000 in the Sunda Strait.

3. The National Marine Environment (LLN) Map to support the marine development sector.

The LLN Map is a basic map that provides information specifically for marine socio-economic development areas. The LLN map is a graphical representation of the earth's surface dominated by the sea, created by the generalization system (map scale of 1: 500,000 and 1: 250,000) (See Figure 6.12). The LLN map scale of 1: 50,000 is produced through the acquisition of data from field activities with hydrographic surveys methods. The benefits of LLN maps are that they support economic growth in small islands, presents accurate region and country boundary mappings, can assist in disaster mitigation, and other infrastructure development planning formulations.



Source: BIG (1993) with permission to re-print from BIG

Figure 6.12 Example of The National Marine Environment (LLN)

BIG's 2013 report shows that 44 Number Sheet Map (NLP) map scale of 1: 500,000 LLN maps were produced. Those maps cover the entire Indonesian territory.

Beyond producing national base maps as fundamentals of spatial plan maps, based on Law No. 4 of 2011 and The Indonesian Government Regulation No. 8 of 2013, BIG has a role in validating spatial plan maps before they can be passed into spatial planning regulations for particular areas.

> *"At BIG, there is a specific unit to verify or give adequate technical assessment of all spatial plan maps in spatial plan documents [general and detailed spatial plans] to be set as a regulations. The unit exists because, spatial plan maps issued by provinces or local planning boards have not been standardised (e.g., in legend, scale, geographic coordinates and datum). Therefore, this unit serves to provide guidance and technical consultation related spatial plan mapping."*
>
> (BIG middle management staff: Interview at 4th February 2015)

d. Substantial issues regarding spatial data management in BIG and Indonesian NSDI application for Spatial Planning Purposes

In-depth interviews and observations in BIG indicated that the spatial data production focuses on two deputies, the Deputy of Basic Geospatial Infrastructure (IGD) and the Deputy of Thematic Geospatial Infrastructure (IGT). While, the Deputy of Geospatial Information Infrastructure (IIG) manage the integration between these two deputies. However, in daily practice, integration of spatial data does not always run smoothly. Several impediments factors can be recorded from three senior management staff interviews.

1. *"Since the One Map Policy was launched in 2011, as could be expected while one particular official government agency has already produced specific spatial data themes, such as the coastlines, other government agencies no longer make spatial data with the same theme, in this case, the coastline. In practice, spatial data duplication is not only conducted by government institutions, but also occurs internally in BIG. The Deputy of Basic Geospatial Information [IGD] has already produced the coastline feature, but another deputy [Deputy of Thematic Geospatial Information] also produced the coastline feature in mangrove mapping."*

   (BIG senior management staff No.1: Interview at 4th February 2015)

2. *“Basic spatial data themes in IGD for all Indonesia are still incomplete, which directly inhibits the preparation of spatial plan maps. Then thematic mapping itself is also constrained, because thematic spatial data of BIG and Ministries/government agencies is incomplete for spatial analysis in spatial planning.”*

   (BIG senior management staff No.2: Interview at 4th February 2015)

3. *“Related to Indonesian NSDI, spatial data integration within BIG itself still having problems. The lack of integration between one working unit and others producing same theme means spatial data duplication still occurs. Technological aspects [in the case of internet infrastructure] remains weak, particularly related to the bandwidth speed. In addition the mindset of staff regarding spatial data production [measn that] some working units still apply the restricted access only, and still think "if they [other institutions or individuasl] ask our data, they should pay based on our time and energy costs. we object to give data freely, because we have made it with difficult conditions".”*

   (BIG senior management staff No.3: Interview at 4th February 2015)

From these interviews it can be seen that there are still problems with spatial data management performance by the working units under BIG, and internal spatial data sharing constrainsts still occur. The problems can be identified as

1. Organisational communication of thematic spatial data productions with other sectoral ministries and agencies is not optimal.

   The organisational communication is not running well due to differences in perception, the method of analysis or methodology and data collection procedures (such as differences in definitions, classifications, units or sampling frames) between BIG and other sectoral Ministries, as well as with agencies responsible for producing thematic spatial data.

2. Lack of technology

   Limited network infrastructure bandwidth in Indonesia causes slow spatial data access (downloading and uploading activities), and data access outside BIG office areas remains time consuming.

3. Many access permit to request spatial data (not through a single point permit)

 The absence of Center of Information and Data (PUSDATIN) unit, which manages the distribution of spatial data transactions in formal bureaucratic procedures, causes data that has not been verified or agreed yet by BIG will be published outside BIG. Thus, convoluted traffic data transactions between government agencies may occur and this can cause data duplication or affect data quality, if data is produced under non-standardised specifications.

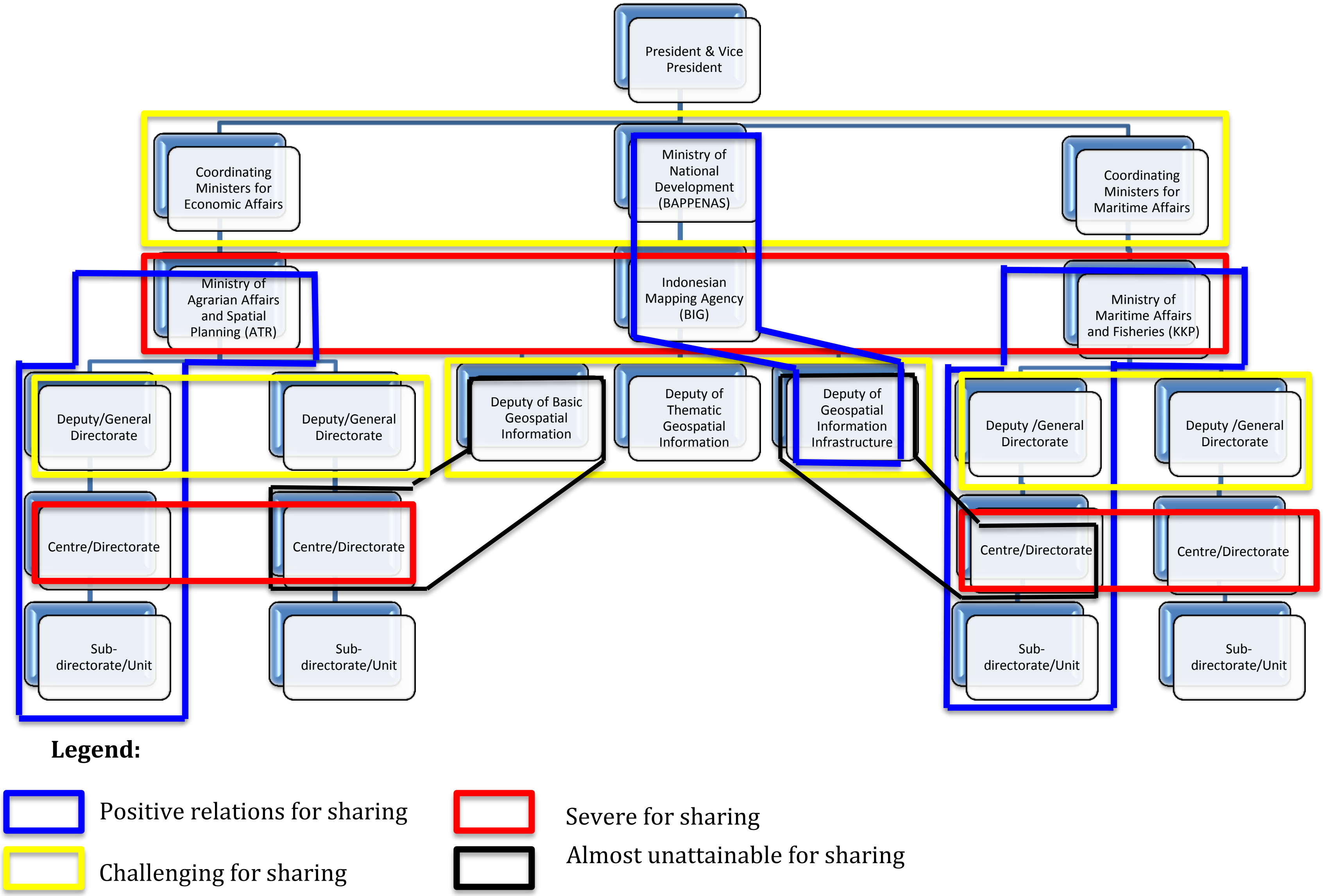
4. The existing basic and thematic spatial data does not meet the need for planning purposes.

   As yet, the whole of Indonesia has not been fully mapped due to: the vast area of the country; the lack cartography skills and training; the BIG organisational structure that does not have representatives at regional and local levels; and the limited budget of the state

   Based on the annual presentation by BIG through Centre of Spatial Planning and ATLAS in 2014, the base map of Indonesian *Rupabumi* Map at 1: 50,000 scale has been conducted for 73% of the national areaat 1: 25.000 scale, mapping has been conducted for 30%; at 1: 10,000 scale mapping has been conducted for 1.17%; and map scale of 1: 5,000 for 0.14% of the country (Suprajaka, 2014).

6.4.5 General spatial data sharing circumstance at central government level

The study of spatial data management in three Ministries and one central government agency, particularly those having direct access to use and process spatial data for spatial planning process, provides a general overview of the significant spatial open data issues in trans-horizontal and trans-vertical institutional relationships. Current spatial data and information flows for the existing spatial planning process in Indonesia can be seen in Figure 6.13



Note: This diagram was built inspired by Samadhi (2014) with modification

Figure 6.13 Inter-Agency Relationship for Spatial Data Sharing in Indonesian National Level

Figure 6.13 shows that spatial data sharing between Ministries / government agencies is not performing well due to poor coordination between them and because it is unclear what the Ministry / central government agency's role is when becoming a data custodian for a particular theme. Lack of trust between Ministries / central government agencies leads to unnecessarily complicated data transactions and inhibits the dissemination and optimal use of data. In effect, spatial data and information sharing in Indonesian central government organisations is conducted in institutions which structurally disregard predominantly trans-horizontal data and information exchange.

Based on in-depth interviews with senior and middle management staff, content analysis of the internal report covering spatial data management, and from observation of the working atmosphere in the working units in Ministries and state institutions, it appears that the main issues related to spatial data management at central government level can be linked to the five SDI pillars (data, people, technology, policy, organisation) (See Table 6.4).

Table 6.4 The Matrix of General Spatial Data Management Issues In Indonesian Central Government Agencies

Components	Issues
Data	Spatial data type/content that can be shared
	Spatial data format
	Spatial data maintenance
	Quality
	Accuracy
	Spatial data updates
	Digital spatial data availability
	Metadata
	Difference scales, content and symbols amongst working units
	Inconsistent spatial data classifications and methodologies amongst working units

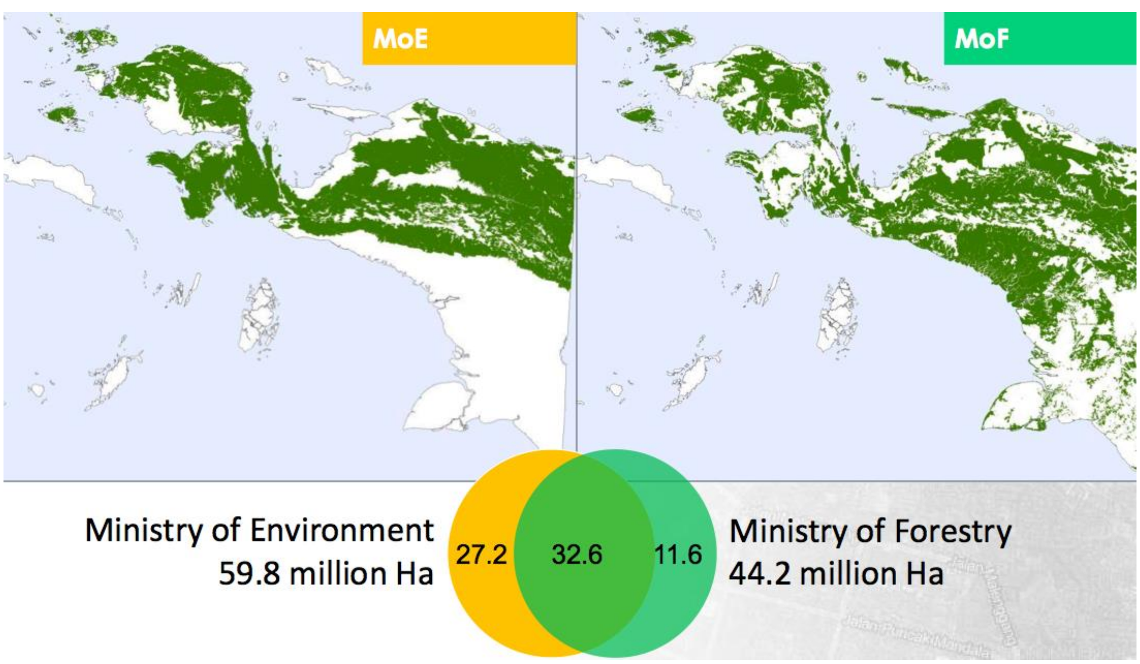
People	Willingness to share data
	Human capital
	Availability of trained personnel in cartographic and GIS skills
	Numbers of participating institutions in SDI network
	Number of spatial data suppliers
	Number of spatial data users
Technology	Spatial data access mechanism (searching and downloading procedures)
	Network architecture (server, internet network accessibility)
	Availability of basic technology devices to create, store, share spatial data (software and hardware)
	Response Time
	Number of spatial data sharing portal visitors
	Frequency of spatial data sharing portal updates
Policy	Spatial data ownership
	Legal arrangements
	Intellectual Property
	Funding
	Pricing
	Socio-political stability
Organisation	Organisational hierarchy (vertical & horizontal relationships)
	Institutional arrangements
	Leadership style
	Vision (long-term Political goals)
	Initiatives connected to SDI
	Communication channels
	Access privileges
	Partnership arrangements
	Competition between working units under a Ministry/agency or between each Ministry/agency
	Lack of formal exchange and sharing data and information protocols

The identification of spatial data management issues will be used as a premise for analysing spatial data exchange and sharing models in Chapter 10. The research findings from fieldwork regarding the main issues of spatial data management provide a general view that the spatial data management practices in the Indonesian central government today are problematic.

Due to the potential for conflict to be caused by different types of spatial data collected by national government institutions, in 2011, the central government through the President has launched a One Map Policy that aims to introduce a single standardised geographic reference, scale and spatial data symbols.

6.5 One Map Policy in Indonesia

One Map Policy (OMP) initiated since 2010 when the Presidential Work Unit for Development Monitoring and Control (UKP4) pointed out the coverage of the forest maps of the Ministry of Environment and Ministry of Forestry had different perspectives (See Figure 6.14), which triggered President Susilo Bambang Yudhoyono launched the policy in 2011 under Law No.4 of 2011.

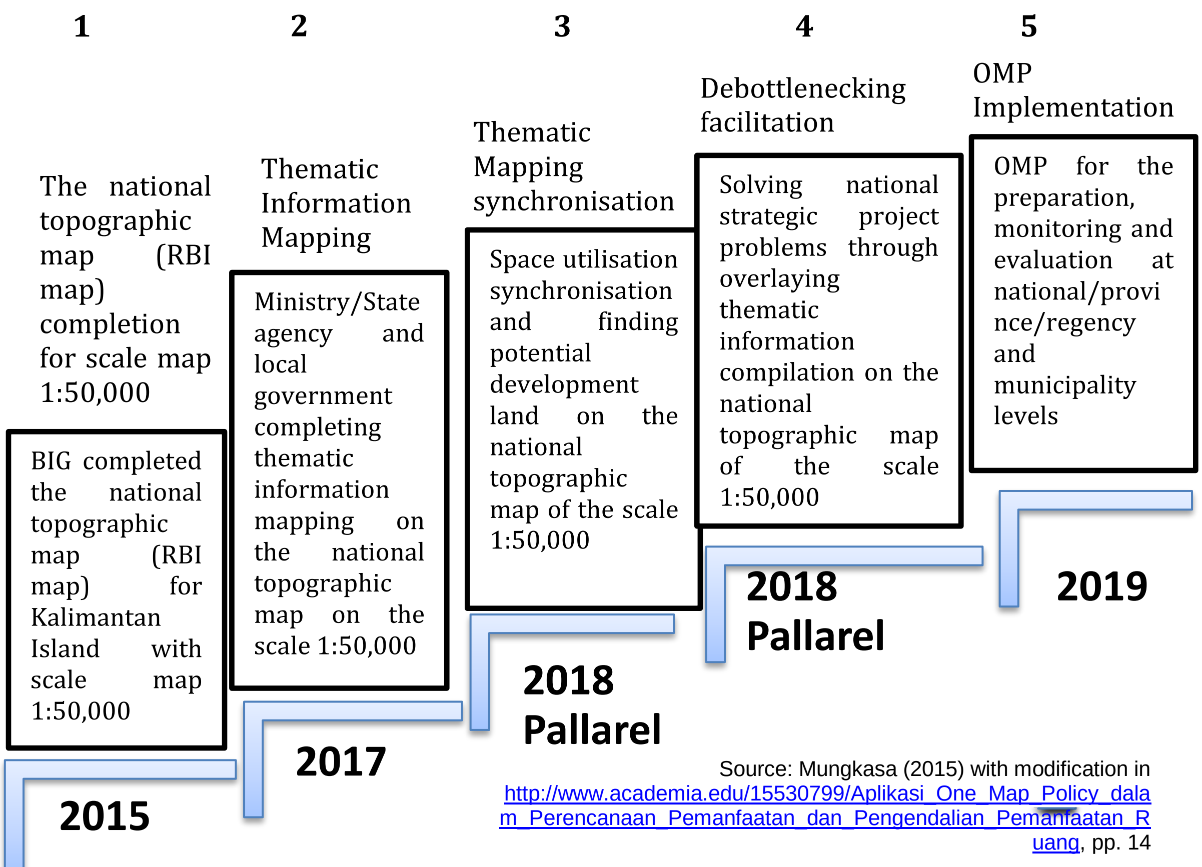


Source: Samadhi (2013)

Figure 6.14 The Different Forest Areas Between Ministry of Environment and Ministry of Forestry

OMP is mandated by Law no. 4 of 2011 on Geospatial Information, organised on principles of legal certainty, alignment, transparency, currency, accuracy, usefulness, and democracy. This policy aims to realize the implementation of the geospatial information in efficient and effective ways through cooperation, coordination, integration, synchronization, and encouragement of geospatial information use in government works and in various aspects of community life. BIG has the role of ensuring that the various digital spatial data produced by Ministries and government agencies are integrated into a single reference map.

Along with the implementation of the National Medium-Term Development Plan (RPJMN) 2015-2019 and orders issued by President Joko Widodo in Economic Policy Package VIII, the realization of OMP efforts by the Indonesian government is a gradual process beginning with aim producing unified standards, map references and a spatial data portal in the next five years (2015-2019) (See Figure 6.15).



Source: Mungkasa (2015) with modification in http://www.academia.edu/15530799/Aplikasi_One_Map_Policy_dalam_Perencanaan_Pemanfaatan_dan_Pengendalian_Pemanfaatan_Ruang, pp. 14

Figure 6.15 One Map Policy Roadmap (2015 – 2019)

Presidential Decree No. 9 of 2016 on Accelerating the Implementation of OMP in the Accuracy Rate Map Scale 1: 50,000 encourages the use of Geospatial Information for government works. This regulation confirms, that the acceleration of OMP implementation on the level of accuracy of a map scale of 1: 50,000 aims to create a map that refers to one reference, one standard, one database and one geoportal in order to accelerate the implementation of national development.

Accelerating OMP implementation is intended to function as:

a. IGT (Geospatial Information Thematic) data reference in each Ministry; and
b. Land use planning reference at the large scale that is integrated in the Spatial Plan documents.

There are four activities for accelerating OMP Implementation:

a. Thematic geospatial information (IGT) compilation owned by the Ministry / government agencies, National Working Group on IGT, and the local government for the whole of Indonesia;
b. IGT data integration through a process of correction and verification through IGD (basic geospatial information) reference;
c. IGT data integration and synchronization ;
d. Recommendations and IGT dispute resolution facilities, including the provision of budgetary allocations overcome problems.

The government has formed a team for OMP acceleration, which is in charge of:

a. Establishing strategic coordination needed to accelerate the implementation of the OMP;
b. Making policy decisions in the context of solving problems and reducing barriers to the implementation of the OMP;
c. Monitoring and evaluating the accelerated OMP implementation and action plan for accelerated OMP implementation in particular; and
d. providing guidance to the Executive Team for conforming to the stated purposes of accelerating the OMP implementation.

OMP realization is one of the good governance implementations through coordination, collaboration, cooperation and integration amongst Ministries and government agencies to conduct vision and mission equalization to conceive, develop, and update planning development data in the spatial data and information context. In achieving good governance in terms of national spatial data management context, OMP in Indonesia is implemented through National Spatial Data Infrastructure (NSDI).

6.6 The Indonesian NSDI

One of the methods for embodying the law's mandate is by authorizing Presidential Regulation No. 27 of 2014 of *Jaringan Informasi Geospasial Nasional* (National Spatial Data Infrastructure/NSDI), also known as the National Geospatial Information Network (NGIN). NGIN application in Indonesia consists of five primary pillars: policy, institution, technology, human resource, and standards. The policy defines all legal aspects including rules and regulations in NSDI operationalisation.

In this context, 'institution' means institutional structures of a geospatial network hub or custodians that consist of dissemination units and production units in local and central governmental agencies. 'Technology' means various technologies for collecting, processing, storing and securing, disseminating, and using spatial data and information. 'Human resources' are related to building individual capacities for geospatial understanding.

Finally, 'standards' play a critical part in ensuring that the four other NGIN's pillars can be successfully implemented, so that national data sharing conducted from Indonesia's geospatial portal (http://portal.ina-sdi.or.id/) can be organised seamlessly. NGIN is a management system for establishing geospatial information in simultaneous, orderly, continuously, measurable, integrated, and practical ways.

The infrastructures of NGIN consist of:

6.6.1 Standards

Standard is a technical specification or formalized instance including its procedure and method approved by related parties and the technical committee through a national consensus and authorised by National Standard Agency of the Republic of Indonesia (Government Regulation No.102 of 2000, Arcticle 1). The term 'related parties' refers to government, spatial data producers and consumers, and geospatial experts. The 'technical committee' is Technical Committee 07.01 for Geographic/Geomatic Information. This Committee is legalized by the Head of the National Standardisation Agency of the Republic of Indonesia and consists of 11 members having a prerogative right to propose, compose, evaluate, approve, or refuse certain geospatial specifications proposed by technical units (Kardono *et al.* ,2015). The purpose of national standard compilation is to embody the One Map Policy, by:

1. Giving guidance to create integrated and aggregated spatial data by using formalised procedures in spatial data acquisition, processing, storage, and security to avoid spatial data duplication, inaccuracy, and inconsistency;
2. Giving guidance to facilitate and accelerate the implementation of national spatial data sharing;
3. Giving guidance for composing, evaluating, abolishing and renewing specification documents according to the development of geospatial technology, so that all the specifications can be fully utilised;
4. Giving guidance on personal capacity accreditation and certification in geographic/geomatic fields.

Spatial data standardization in the Indonesian NSDI context includes three things:

a. Data
b. Metadata
c. Access

a. Data

Spatial data standardisation is set in the Indonesian Catalogue of Geographic Elements (*Katalog Unsur Geografi Indonesia*/KUGI) that contains elements and attributes used by spatial data and information producers and users in building a spatial data structure. KUGI contains 13 categories, namely: spatial reference, boundaries, transportation, hydrography, hypsography (determination of relative elevation of areas of land) , vegetation, built environment, utilities, geology, soils, toponymy, cadastre and specialised datasets.

b. Metadata

Indonesian spatial metadata standardisation refers to the Indonesian Spatial Metadata Profile (ProMsI 1.0), which is arranged on the main elements of metadata specified in ISO 19115: 2012. ProMsI 1.0 describes geographic information about the identity, size, quality, spatial and production time, the spatial reference, and distribution of digital geographic data.

c. Access

The standardisation of spatial data accessibility in this context related to the common data formats that can created interoperability with other spatial devices.

Indonesian NSDI implementation is in line with the aims of the One Map Policy to create coherence and synergy in both basic and thematic spatial data or information. The Indonesian government has set eleven main national themes for establishing spatial data and information standards between government institutions:

1. Natural resource and watersheds;
2. Farming and peatland;
3. Dyanmaic resources;
4. Climate change;
5. Ecoregions;
6. Transportation;
7. Disaster study;
8. Spatial planning
9. Marine resources, coastal and small islands;
10. Social economy, culture and ATLAS;
11. Sectoral zoning, land cover, and land status

6.6.2 Human Resources

Human resource is dynamic and continuously developing field. Regular improvement is necessary for human resource capacity along with the development of technology, particularly in geospatial technology. The minimum knowledge requirements for human capacity in geospatial technology are:

a. Basic knowledge of spatial data, including geodetic control networks, geospatial reference systems, and survey and mapping activities.
b. Basic knowledge of spatial data manipulation, including a database systems, geographic information systems, and digital cartography.
c. Basic knowledge of spatial data infrastructure, including general concepts and a principles of geographic information infrastructure, metadata, geospatial clearing houses, interoperability systems, geospatial standards, fundamental data sets, and data integration.
d. Basic knowledge of information technology and networks, including computer programming, networks (WAN and LAN), and GIS internet.

(Kardono *et al.* 2015)

In addition, personal capacity in geospatial technology should be proven by accreditation and certification procedures. Such qualifications can be gained through a GIS and data management course or training conducted by BIG, a centre for spatial data infrastructure (PPIDS) or universities, and should be synchronised and legalised in the form of a national standard for competency in geographic work.

6.6.3 Technology

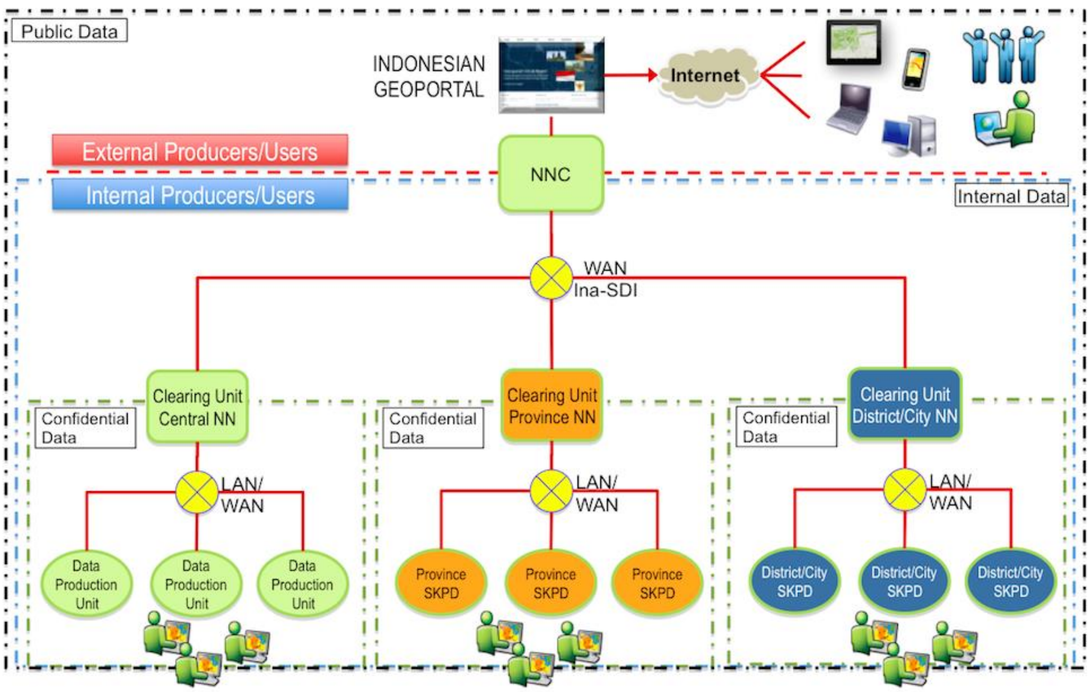
The technological aspects of the Indonesian National Geospatial Information Network includes:

a. Technology aspect in geospatial data acquisition
b. Technology aspect in geospatial data and information processing

c. Technology aspect in geospatial data and information storage and security
d. Technology aspect in geospatial data and information distribution
e. Technology aspect in geospatial information utilization

(Kardono *et al.* 2015)

The implementation of a particular technology has to be accompanied by standards/technical specifications for transparent and interoperable spatial data and information utilisation in data sharing management. Spatial data and information distribution amongst institutions (spatial data sharing) is operated through http://portal.ina-sdi.or.id/. This portal has spatial data and metadata storing capabilities, for securing and sharing data amongst institutions. Figure 6.20 shows the topology of national spatial data sharing through the Indonesian geospatial portal.



Source: Kardono *et al.* (2016)

Figure 6.16 Topology of National Spatial Data Sharing

Figure 6.16 shows the architecture of the Indonesian NSDI Geoportal, called Ina-Geoportal, developed by combining elements of the Environmental Service Research Institute (ESRI) Geoportal with the use of middleware Oracle web center.

This model is expected to enable geoportal-based open source applicaitions to interact. The Ina-Geoportal has been developed using three tiers, namely: database, middleware and application.

The database tier is located at the lowest level of data sharing technology for spatial data storage activities and metadata from spatial data producers at central, provincial and regency/municipality levels. Spatial data stored adopts the Indonesian Geographic Catalogue Elements standard (KUGI) while the metadata standard follows the Indonesian country profile. At this level, spatial data exchanged is included in the category of **confidential data**, where the sharing and exchange activities occur only in working units of a particular government institution.

The middleware tier is located at a mid-level in the data sharing aspects of the technology and was developed as a liaison server between the spatial data producer and user. At this level, spatial data exchanged is included in the category of **internal data**, which can be exchanged or shared between network hubs that are listed in the ina-geoportal.

Finally, the application tier is located at the top level of the aspects of data sharing technology and was developed to show the front page of spatial visualization. At this stage, the spatial data exchanged is included in the category of **public data**, viewable and exchanged by all users who have registered on Ina-Geoportal. (See Figure 6.17)

source: http://portal.ina-sdi.or.id/

Figure 6.17 The Indonesian NSDI Geoportal

6.6.4 Institutions

An institution in the Indonesian NGIN context describes an institutional structure to build a strong connection between national and local governments with the authority for establishing basic and thematic spatial data and information. There are four institutional structures which should be formed in NGIN :

a. Network Node Connector (NNC)

NNC is the institution establishing national network node integration. The Geospatial Information Agency of the Republic of Indonesia (BIG) is the assigned agency for playing this role.

b. Network Node (NN)

NN is the institution responsible for establishing certain geospatial data acquisition, maintenance, renewal, exchange, and distribution. NN may be either a central or a local government institution establishing thematic geospatial information. In practice, the local NN structure is appointed by local government.

c. Clearing Unit (CU)

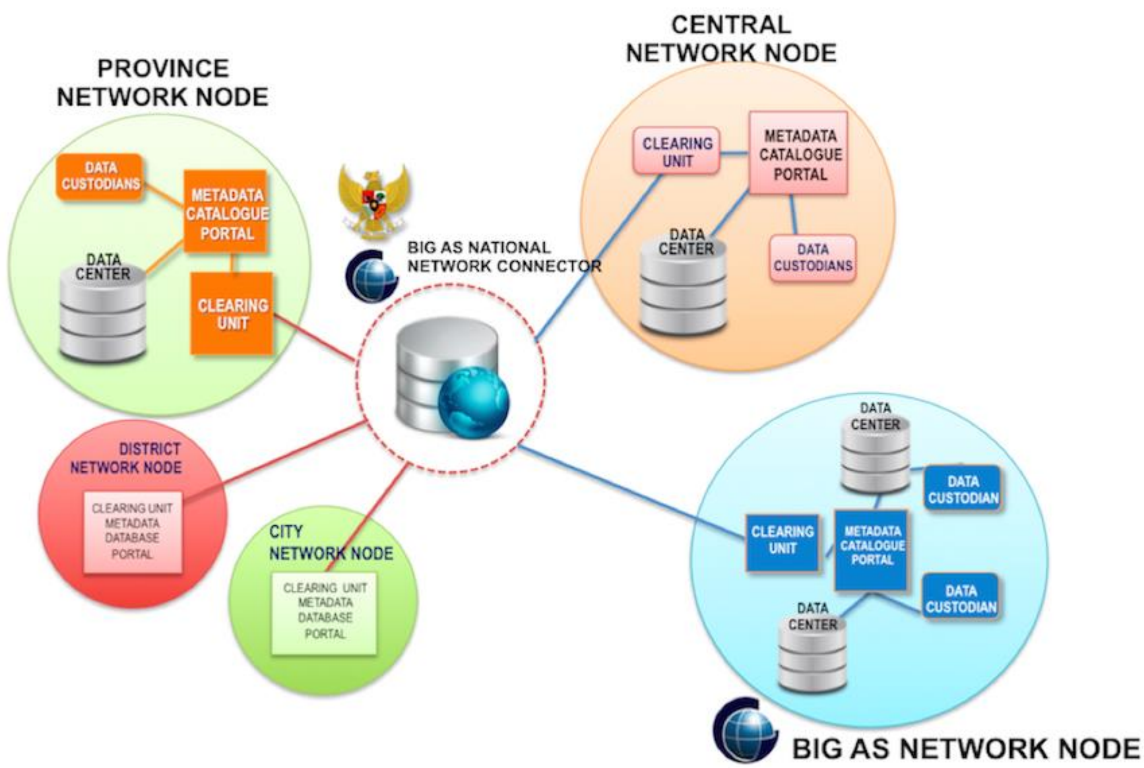
CU is part of the NN structure responsible for storing, securing, and distributing geospatial data and information. CU is appointed by the head of the NN group.

d. Production Unit (PU)

PU is a part of the NN structure being responsible for collecting, processing, storing, and utilising spatial data and information. PU is appointed by the head of the NN group.

Kardono *et al.* (2015)

Each of these components has its function which has to be harmonised, synergised, and legalised through local government provision to embody the national geospatial information network. Figure 6.18 shows the relationship among institutional structures in NGIN.



Source: Kardono *et al.* (2015)

Figure 6.18 The Relations Between Government Institutions in Indonesian Spatial Data Infrastructure

6.6.5 Regulations

Regulation in the Indonesian NSDI context is the written rules that have binding force for spatial data sharing implementation. The SDI implementation regulations are divided according to the Indonesian government central, provincial and local (municipality and regency) administrative levels.

At the central level, the SDI regulation is issued by the Minister / head of the agency; the provincial level, the regulations are issued by the Governor; and at the local level, the regulations are issued by mayor for municipality administration level and *bupati* for regency administration level. Government regulations at provincial and local levels involve the approval of local parliament to achieve legitimacy.

The components that need to be included in the SDI regulation are:

1. The establishment of the working unit as a spatial data custodian;
2. Setting coordination amongst units involved in SDI operation;
3. Setting the organisational structure of SDI operation;
4. Spatial data and information collection, processing, verification and dissemination activities;
5. Spatial data and information storing and securing mechanisms;
6. State budgeting scheme for SDI operationalisation of in the form of hardware, software, data providers, internet subscriptions, and maintenance schedules.

At the national level, the primary documents used as principal references for Indonesian NSDI are as follows:

1. Geospatial Information Act No.4/2011;
2. Presidential Decree No. 85/2007 of the National Spatial Data Network;
3. Presidential Decree No.27/2014 of the amendment National Spatial Data Network;
4. Presidential Decree No.9/2016 of the acceleration of implementation of the One Map Policy for the accuracy level map scale 1:50,000;
5. The Indonesian National Spatial Data Infrastructure guidelines;
6. The Indonesian NSDI Clearinghouse guidelines;
7. The Indonesian NSDI Custodian guidelines;

8. Governmental Regulation No.15/2007 of Spatial Planning Act Practices;
9. The relevant reports prepared by government institutions pertaining to NSDI implementation and Spatial Planning formulation;
10. National Development and Planning System Act No.25/2004;
11. Indonesian Long-Term Development Plan 2005-2025;
12. Indonesian Medium-Term Development Plan 2015-2019.

6.7 Summary of Chapter

This chapter investigated the development of open data in Indonesia related to data sharing implementation, including spatial data development and sharing in Indonesian central government institutions. Based on interviews, observation and document study, it was found that spatial data development in central government level largely takes places in 'data silos'. As result, spatial data and information sharing in both trans-vertical and trans-horizontal relationships between Ministries and other government agencies is not yet occurring.

Solutions to this problems have been sought since 1990 when the Indonesian National Mapping Agency began to coordinate national spatial data management. However, for the last 20 years the Indonesian government has not been aware of the importance of spatial data management, which has allowed 'data silos' to be created and managed by the different government agencies. The government started to give more attention to spatial data integration in 2010, when President Susilo Bambang Yudhoyono found that the Ministry of Environment and the Ministry of Forestry were producing different maps of Indonesian forestry areas. Since then, the Indonesian government instituted a "One Map Policy" in 2011 through Law No.4 of 2011 and derivative regulations of Presidential Decree no. 27of 2014.

The One Map Policy and Presidential Decree no.27 of 2014 reinforced by Presidential Decree No. 9 of 2015 aimed to accelerate the production of national maps at scales of 1: 50,000 across Ministries and government institutions, and indicates that the Indonesian NSDI era has re-started. NSDI implementation is set in the of the programme for production of standardised OMP over the period of 2015 - 2019, which coincides with the implementation of the Medium-Term National Development Plan 2015-2019. As a consequence, all government institutions are obliged to share their spatial data. Overall, the discussion in this chapter attempted to answer the second research question: ‘What process has the central government of Indonesia used to develop NSDI?’

Given the tradition of each government agency producing its own data solely for its own use, there is a shortage of updated spatial data and information available to the public. This is also because of limited budgets and human resources in the Ministries or other government institutions that interact with spatial information. To counteract this lack of public availability of spatial data and information, government cooperation with voluntarily community provision of spatial data (VGI) can be an alternative solution, and this will be discussed in the next chapter.

CHAPTER 7

FROM PARTICIPATORY MAPPING TO VOLUNTEERED GEOGRAPHIC INFORMATION IN INDONESIA

7.1. Introduction

The previous chapter discussed the development of open data in Indonesia related to the implementation of spatial data sharing, including spatial data development and exchange amongst government institutions. Investigation of spatial data management in three Ministries and one central government agency reveals that updating spatial data still a barrier to spatial data management performance at the central government level.

One solution to updating spatial data and information might be through collaboration with civil society in the voluntary production of spatial data and provision, known as volunteered geographic information (VGI). In this chapter, the researcher explores VGI in Indonesia and its role in the context of spatial planning processes.

Initiation concept of participatory research emerged in the era of 1960s, with the proliferation of widespread social repression as a result of the second world war in the West (viz. Europe). It triggered social studies to involve the community in overcoming the problems of urban and regional issues at the time. Furthermore, the emergence of Marxist influence to overcome the influx of social justice issues in the social sciences in the 1970s encourage the development of research methods aligned to marginalized communities. One of the breakthrough social research methods was a participatory research initiated by Freire, who use the method of dialogue between elites and citizens in overcoming problems in marginalized communities.

Participatory research is one of the breakthroughs in social research that see knowing subjects as capable of making their own knowledge about themselves (Freire, 1971). The implication of this approach is the use of dialogue in research methods to support communities to take control of their own lives and change repressive conditions. In this sense, the method of citizen participation from participatory mapping to VGI can be understood as a process of political dialogue between the communities being affected by government planning policies and the government making the policies.

Currently, the growth of the internet has supported various human activities, including demands for information related to spatial analysis and more specifically, provides opportunities for spatial policy formulation in cooperation with publics wanting more control over their own spaces. The needs of civil society and governments increasingly demand accurate data and information.

Civil society as an actor in governance for the implementation of spatial planning has a role in developing, using and managing selected target planning regions in the government agenda. In Indonesia, the Geospatial Information Act of Law No. 4 of 2011, Article 23, Paragraphs 1 and 4, and Law No.26 of 2007, Article 65 on spatial planning provide an opportunity for participatory-based approaches to the provision of spatial data and information to achieve spatial planning policy goals.

A variety of community participatory-based activities have direct effects on government policies and programmes. In 2004, the Asian Development Bank (ADB) presented a comprehensive report on public participation in decision-making processes and argued that the participatory approach in the implementation of government programmes is efficient and accommodates social aspirations at low-cost but with positive outcomes for communities (ADB, 2004).

There have been many studies by GIS and planning scholars of community-based spatial data management and usage for regional planning purposes (e.g. Roche, 2014; Roche et al., 2013; Heipke 2010; Haklay and Weber, 2008). In general, their research shows that communities affected by government planning and development agendas are helped immensely by participatory mapping approaches that assist in creating political dialogue with decision-makers. At the same time, from the perspective of the political elites, governments receive valuable input to align community needs with the realisation of the government development agenda.

In Indonesia, a variety of community-based research approaches to spatial data usage, from paper-based mapping to GIS, GPS and WebGIS digital-based methods, have been applied to various social problems (Aditya, 2010; Mustofa et al., 2014). This chapter answers the third research question: ‘How is spatial data created by citizens used in Indonesia?’ by discussing the characteristics of spatial data usage by civil society to support spatial policy formulation, starting with the history of participatory mapping to current VGI development in Indonesia.

7.2 Spatial data usage by civil society in Indonesia

This section discusses the characteristics and development of spatial data usage by civil society to support any activities related to spatial planning processes in Indonesia. The discussion begins by exploring the history of spatial data usage through the printed spatial visualization (viz. map) by indigenous people, known as participatory mapping. Understanding the historical background of participatory mapping provides knowledge of the beginnings of spatial data use by civil society. The discussion is continued by examining the role of participatory mapping in spatial planning advocacy in Indonesia.

Entering the open data and internet era, spatial mapping methods have changed from paper-based to digital spatial data formats. Now many people produce and share spatial data voluntarily to achieve specific goals. Thus, participatory mapping that was originally limited to communities living in a particular region, now through digital mapping, can be created and used by communities from other areas as well. This is called crowd-sourcing geographic information, which in this research involves VGI. Research into VGI for this thesis will be discussed after exploring the history of participatory mapping in Indonesia.

In relation to suggesting potential integration of official spatial data, after exploring VGI initiation and characteristics in Indonesia, the next section will examine the experience of VGI collaboration with government institutions. The discussion of VGI and SDI integration focuses on the role of spatial data generated by VGI community in supporting government programmes section.

7.2.1 Historical background of participatory mapping in Indonesia

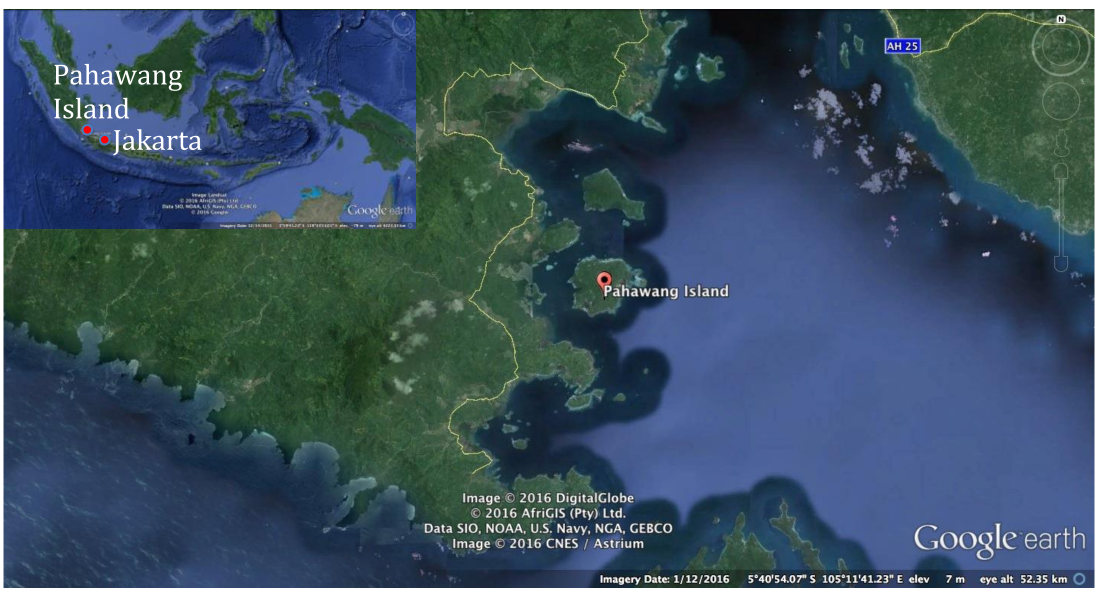
Participatory mapping initiation in Indonesia to be carried out by indigenous people, communities, and the Non-Governmental Organisations (NGOs) for the advocacy in spatial planning for their land when it was proposed for commercial development. Many indigenous people and communities have used participatory mapping methods to negotiate with planning actors, such as the government and businesses. Planning advocacy through participatory mapping in Indonesia has been strengthened, especially in relation to the increasing number of spatial impact of policies contained in local spatial plans (RTRW), either at the province or regency/municipality levels.

The participatory mapping activities related to spatial planning in Indonesia can be identified as two types; firstly, mapping activity for advocacy zone management between communities; and secondly, mapping activity for advocacy zone management amongst indigenous or rural communities with over development agendas in their region.

The mapping activity for advocacy zone management can be defined that civil society participates and engage to keep their claim territories regarding natural resource management through participatory mapping (Rizani and Karim, 2009, pp.163). The map from participatory mapping result can be used to as a media to presents issues regarding their areas to other parties (e.g. government, investor, developer) for land right advocation purposes (Rizani and Karim, 2009, pp.163).

An historical example of mapping in relation to advocacy zoning mapping can be seen in a case study of participatory mapping on Pahawang Island (See Figure 7.1). In this area, the local community used the map to build consensus between traditional fishermen and modern fishermen in relation to fishing activity. The fishing activity areas mapping presented an agreed upon between traditional and modern fishermen only allowed to use the conventional method (e.g. using a fish hook) and not using trawlers, bombs and potassium cyanide concerning fishing activity in maintaining the sustainability of natural resources (Rizani and Karim, 2009).

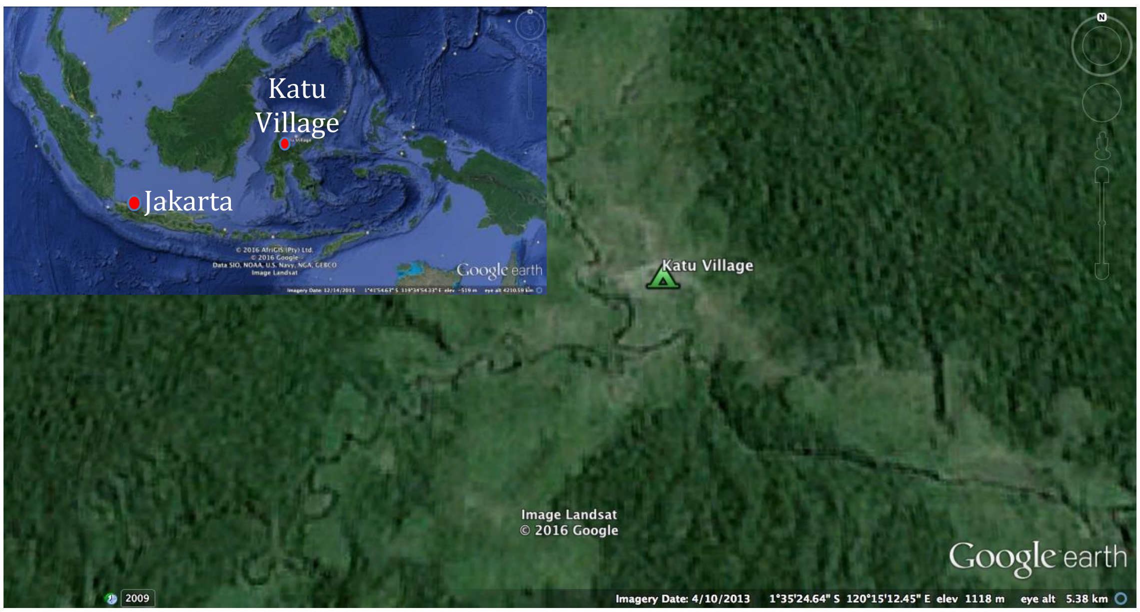
The impact of participatory mapping was that the use of trawlers, bombs and potassium cyanide by modern fishermen were vanished. As a result, fish numbers in the areas surrounding Pahawang island increased, and traditional fishermen are able to continue to fish. In addition, Indigenous society on Pahawang Island has used maps as a basis for the formulation of village regulations, *peraturan desa* (Perdes) formulation (Rizani and Karim, 2009, pp.163).



Source: Google Earth (2016)

Figure 7.1 Pahawang Island Geographical Location

On the other hand, an histrocial example of participatory mapping activities in relation to the management of territory in local community relations with the government is Katu village territory (See Figure 7.2). The map created by the Katu Village community through participatory mapping was used as a basis for proposed activities in the National Programme for Community Empowerment, *Program Nasional Pemberdayaan Masyarakat* (PNPM) and the Accelerating Development of Disadvantaged Areas Programme, *Program Percepatan Pembangunan Daerah Tertinggal dan Khusus* (P2DTK) (Azar, 2009).



Source: Google Earth (2016)

Figure 7.2 Katu Village Geographical Location

The participatory mapping provides an inventory of indigenous peoples' resources and living territories, so that, local spatial knowledge can be recorded. According to Sabu (2009), the implementation of participatory mapping in Indonesia has changed local community perceptions and patterns of natural resource management in four aspects, namely political, social, economics and cultural aspects.

The political aspect

Participatory mapping emerges as an effective means of communication for achieving consensus between indigenous society and governments about spatial planning. Maps provide both actors (an indigenous society and a government) with basic information for discussing spatial territory management (Sabu, 2009, pp.36).

The social aspect

Participatory mapping can changed the way a local society thinks about the area where they live in some of the following ways:

- Indigenous people have local spatial knowledge about their local resources and conditions within their areas and understand the various threats faced;
- Maps have the ability to identify the community involved in territorial management;
- Participatory mapping can contribute to creating solidarity within communities / indigenous peoples.

(Sabu, 2009, pp.36)

The economic aspect

Because indigenous people can produce their own daily food needs from harvesting their own agricultural products, maps produced by local communities are able to identify local natural resources including those valuable to that particular community. As a result, the fulfilment of their daily needs becomes more secure (Sabu, 2009, pp.36).

The cultural aspect

Participatory mapping helps indigenous people to identify, preserve and develop traditional customs and habits in managing the area handed down by their parents from their ancestors. Area management customs and organisations can be explained and illustrated through participatory maps. For example, zones for indigenous forests can be identified, areas considered to have religious purposes can be replanted with plants having significant symbolic value, such as the banyan tree. Participation in the determination of the zones in question allows local wisdom to contribute to the organisation and management of their territory (Sabu, 2009, pp.37.

However, participatory mapping for spatial planning activities does not always run successfully. Problems have occurred due to indigenous people being sceptical of the participatory mapping method. The next section discussed some of these impediments to participatory mapping section.

7.2.2 Impediments to participatory mapping in Indonesia

At the time of the introduction of participatory mapping approaches to solving social problems, local societies had at first been sceptical of this method for the management of their territories. It took a long time and commitment in supporting local society for participatory mapping to become accepted. Sometimes, the benefits can appear only after mapping activities have been completed.

In practice, participatory mapping approaches, from promotion to the ratification of the map, are still not optimal in implementation. Derived from *Jaringan Kerja Pemetaan Partisipatif* (JKPP), The Indonesian Participatory mapping network organisation study in 2009, constraints on the implementation of participatory mapping in Indonesia can be summarized as follows:

- Participatory mapping was of only temporary interest;
- Participatory mapping budget was still predominantly derived from NGOs;
- The idea of participatory mapping was only known by certain local community actors;
- Maps were only put into use when indigenous peoples were in conflict.

(Source: Safitri and Pramono, 2009, pp.229-235)

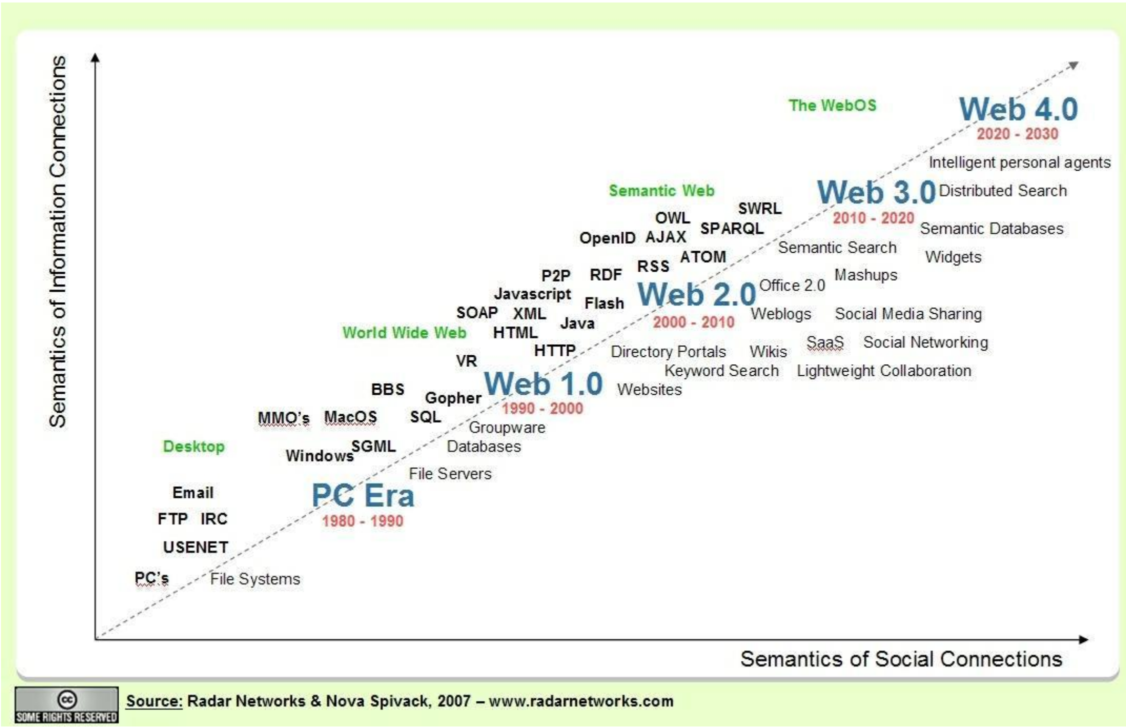
Generally, this research indicates that participatory mapping in Indonesia came about because of the background of agrarian conflict in indigenous communities living in forest regions that intersected with government and commercial interets. Maps are used to claim ownership of an area: for instance, land certificates are issued by the Indonesian National Land Agency (BPN) with maps attached that illustrate individuals tenures and timber concession to companies issued by the Ministry of Forestry (Safitri and Pramono, 2009).

But many forest concessions issued by the Ministry of Forestry were generally located on land that was controlled and managed by indigenous societies who were then able to get bans placed on businesses in areas claimed by timber companies. The situation got worse when the companies claimed land ownership with an attached a map of the forest concession from the government and threatened indigenous groups with intimidation and violence. In other words, spatial information visualization has economic and political functions that can have serious affects on the socio- cultural aspects of the lives of indigenous people.
Participatory mapping relying on paper-based methods has created problems for management and storage. With the fast development of digital technology, participatory mapping methods have changed from paper-based to digital format, and terminologies changed with Participatory GIS (PGIS).

Participatory mapping and PGIS limited to the community level led to limited opportunity to integrate with other spatial data producers, thus spatial data management by indigenous societies, urban communities and government is difficult to integrate. In the light of this situation, in the 2010s, Indonesia introduced a digital-based participatory mapping system, or VGI. The system has capabilities to produce spatial data voluntarily with extensive community outreach beyond their living regions. The metamorphosis of participatory mapping from paper-based, to a VGI system is discussed in the next session.

7.2.3 From Participatory Mapping to VGI Activities in Indonesia

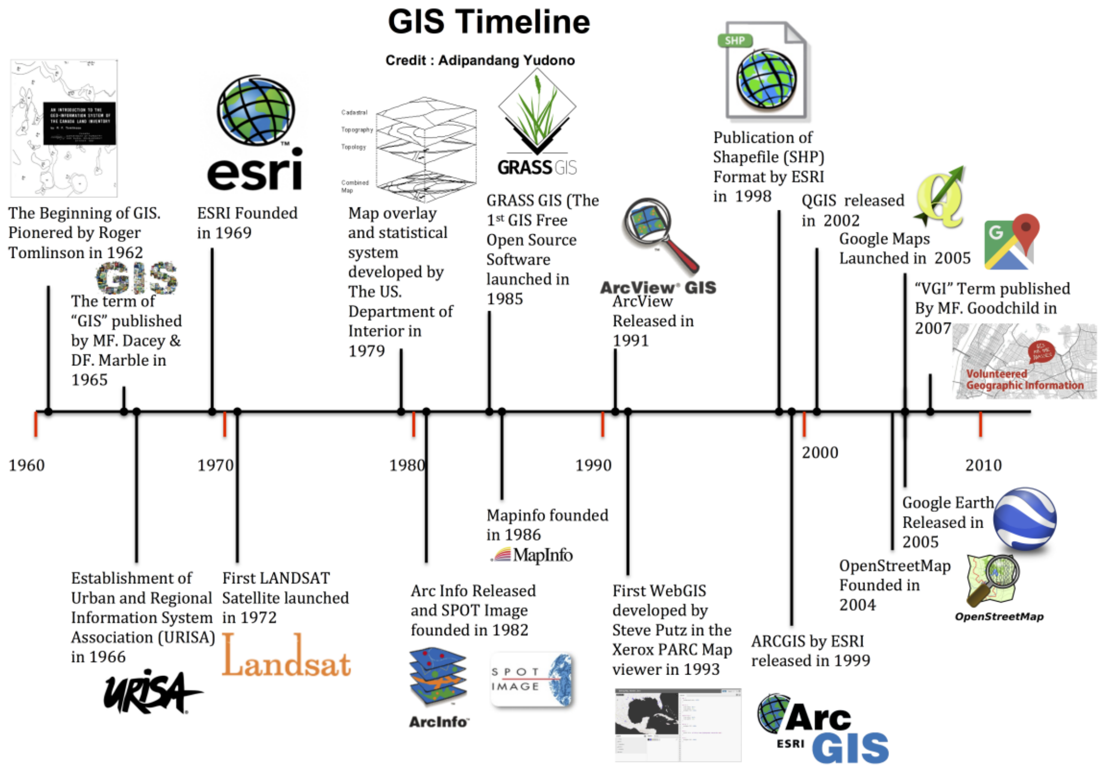
Interactive internet usage is growing rapidly with the next-generation of Web 3.0 which allows not only the interaction between two or more internet users and information providers, but also sharing files. These developments along with facilities for data and information sharing have changed the outlook on the production and use of data, since now the user an also be involved as a data and information producer and provider (see Figure 7.3).



Source: http://nano-marketing.viabloga.com/news/web-2-0-and-above-nnm-is-here-to-stay

Figure 7.3 Internet Generation Era

Relevant to spatial data sharing in the Web 3.0 context, citizens can create and share spatial data and information regarding their territorial living locations on public web mapping application programming interfaces (APIs) such as Google Maps, WikiMapia, OSM and Microsoft's Virtual Earth (Rouse et al, 2007 ; Goodchild 2007; Tulloch, 2007). Historically, in the 1990s, spatial data production and provision was dominated by national mapping agencies. However Since the 2000s, spatial data providers outside government agencies have been widely establish to produce and provide spatial data development and sharing services amongst their communities through support of the internet and mapping technology advances that provides GIS open source for the production and provision of spatial data and information. The development of GIS from a stand-alone application to crowd-sourced geographic information be seen in Figure 7.4.



Created by the researcher in 2016

Figure 7.4 GIS Timeline

Generally, spatial data providers outside government can be divided into two groups: commercial spatial data providers and open public spatial data providers. The first group produces spatial data to be sold or for business purposes. This data and informaiton are produced by GIS professionals. The spatial data generated are encrypted (uneditable format) and cannot be re-processed, unless their clients pay for spatial data and information, they can re-edited it. Spatial data providers in this category include Google maps, Navtech, TomTom and Tele Atlas.

The second category of spatial data provider provides a platform for building spatial data which can be shared amongst communities. Unlike the first group, this group consists of people from various professions with no cartographical abilities but who contribute to the building of spatial databases. The open source nature means there is no charged for downloading data and data can be re-edited and re-added. In other words, this category of spatial data provider is VGI. And include groups like Wikimap, OSM and Waze.

The nature of the provider of spatial data for commercial purposes is not the focus of this study because the data generated for commercial purposes cannot be shared and is retained as the company's assets, but will be used as comparison with VGI products, in this case is Google maps as popular map apps that used for daily social interests, such as navigation. This study focuses on the development of spatial data generated by the public and open source spatial data providers.

7.2.4 VGI initiatives in Indonesia

As discussed in Chapter 2, section 2.6, global voluntary spatial data production has been implemented since 2006 after participatory GIS open source platform released, such as OpenStreetMap (OSM) which were established in 2004 (See Figure 7.4). One of the initial VGI activities in Indonesia was a Green Map Program which was a map generated by local communities to map the potential of natural and cultural resources of the communities' living places. The Green Map charted all places and phenomena, whether positive or negative and aimed to help people see, judge, connect, and care about the environment where they are located. The Indonesian Green Map is a part of the World Green Map organisation and can be viewed at: http://www.opengreenmap.org/greenmap.

Participatory mapping was used for informal or recreational pursuits such as mapping restaurants at: https://www.google.com/maps/d/viewer?mid=1Ok41gwEcc0oW0Nu-D0LKF5wApPQ; outdoor activities at: http://www.navigasi.net and tourist attractions at: https://www.google.com/maps/d/viewer?mid=19cYg4A1S0xD-dXENVYbQ-pnP1d0&hl=en; and traffic conditions using Waze platform at: https://www.waze.com/id/livemap.

These kinds of voluntary GIS activities have been carried out in Indonesia since OSM was released in 2004. Spatial data created by earlier VGI communities was more aimed at displaying targeted spatial objects on the WebGIS platform or putting up geo-tagged objects for personal interest rather than building a geo-database to re-use for various purposes. This section discusses VGI focuses on the GIS platform in the form of building a geo-database to support the spatial planning application.

Drawing on information from interview and field observations, an open source platform with the function of building a voluntary GIS geo-database and spatial data created and shared amongst communities concentrated on Wikimap and OSM providers. Study of the VGI characteristics and developments on both these VGI providers in Indonesia found that OSM is the only provider which has management based in Indonesia. Conversely, Wikimapia does not have an Indonesian management representative and spatial data created by the Indonesian Wikimapia community directly interacts with central management that control by two Russian Entrepreneurship (Kersky and Clark, 2012).

This means it has not been possible to examine VGI in the Wikimap community because the researcher found it difficult to assess official reports and there was no official Wikimapia Indonesia management to interview. Thus, the study of VGI in Indonesia is only represented by the OSM provider. OSM implementation in Indonesia was carried out by the Humanitarian OpenStreetMap Team (HOT) organisation in 2011 to fulfill the needs of spatial data and information before, during and after disaster events. The initiation of Indonesian OSM was sponsored from Australian Aid (AusAID) and the main aim was to carry out natural disaster risk exposure mapping in the eastern Indonesia region (See Figure 7.5). As one of the senior HOT Indonesian organisers explained in an interview:

> *"The entry of VGI activities in Indonesia through OpenStreetMap started from HOT International which aims to help humanitarian issues. Viewing Indonesia's geographical position in disaster prone areas and supported by limited spatial data availability, HOT International entered Indonesia in 2011 to build a spatial database base map with an OSM platform. In May 2011, HOT Indonesia began a pilot project in the form of Community Mapping for risk exposure of natural disasters in Indonesia under the Australian Community Development and Civil Society Strengthening Scheme (ACCESS) project. Social mapping was first focused on eastern Indonesia."*

(HOT Indonesia Senior Management member: Interview at 6th February, 2015)

Source: surveyapjii2014v3-150425070215-conversion-gate01.pdf , pp.14

Figure 7.5 Indonesian Western and Eastern Regional Divisions

The initial activities implementing VGI in Indonesia and carried out in June 2011 include:

- Conducting trial-error experiments using the OSM platform to be adopted in rural and urban areas in Indonesia
- Identifying the need for tools and materials for subsequent mapping of spatial objects transferred to the OSM platform
- Ensuring OSM application can be useful for the assessment of contingency planning and emergency situations. (Source: AIFRD, 2014, pp.1)

Indonesian OSM activities were based on annual projects in which initial activity was to conduct digitization of spatial data on buildings, roads, bridges and other spatial infrastructure objects in urban and rural areas, to support the activities of the government in disaster management. The evaluation of OSM activities to build geo-database for disaster management by the central government showed it could improve central government performance in relation to identifying catastrophe victims. Since 2012, the Indonesian OSM has worked in cooperation with the Indonesian National Disaster Management Agency, *Badan Nasional Penanggulangan Bencana* (BNPB) because BNPB lacked spatial data management experience in identifying and quantifying the impact of disaster events.

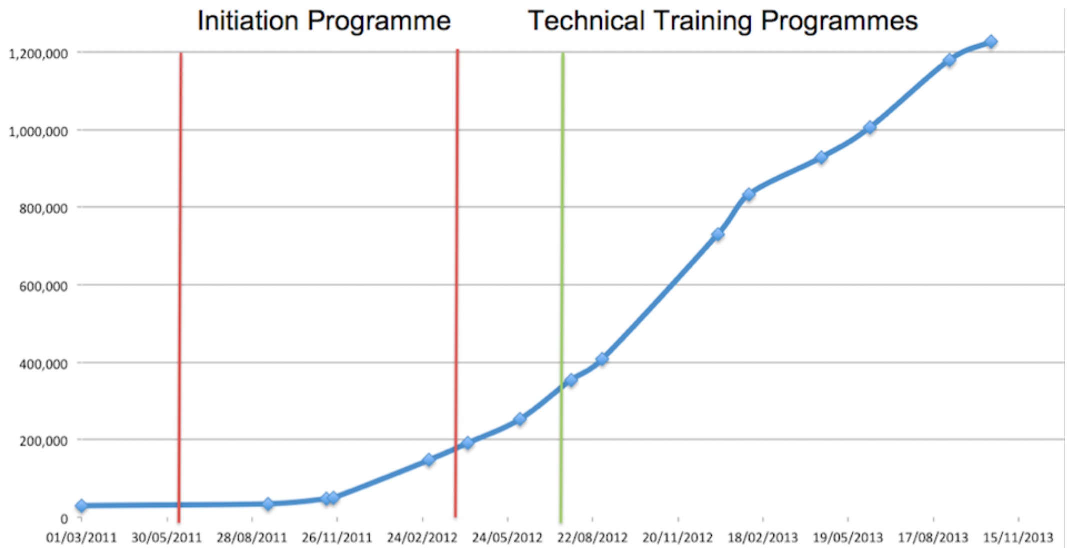
In supporting operationalization in the field, BNPB required spatial information visualisation in large-scale maps (1: 500, 1: 1000; 1; 5000; 1: 10,000). But BIG, as the official government institution for creating and providing spatial data, could not meet the needs of the large-scale spatial data. But at the time of the tsunami and in the post-disaster period, BNPB needed spatial data for disaster management quickly. Constraints on supplying large scale spatial data were further studied and followed up by foreign aid from Australia through the Australia-Indonesia Facility for Disaster Reduction (AIFDR). AIFDR work with HOT international because of their experience in managing community building geo-databases using open source GIS platform (AIFDR, 2014).

Having outlined the historical background to the initiation of VGI in Indonesia, the following discussion will examine current VGI development in Indonesia. This is followed by a discussion of the experience of spatial data usage built by Indonesian VGI communities in relation to activities that interact with spatial planning.

7.2.5 Current VGI Development in Indonesia

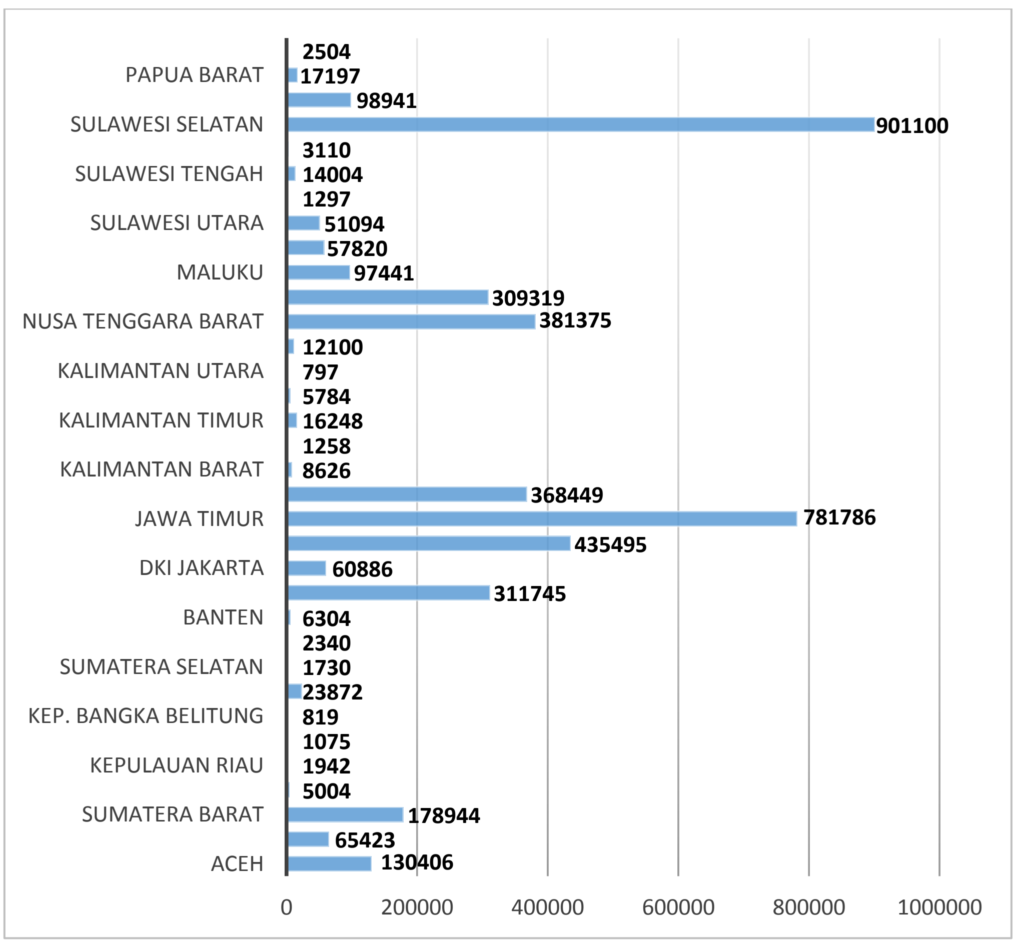
Based on field observations for this research, the development of VGI activities in Indonesia growing rapidly, especially for geo-tagging activities for hobbies like travel, restaurants, locating traffic congestion, hiking and cycling route tracking. VGI activities building geo-databases for updating the latest spatial data and information with GIS-based open source platforms such as WikiMapia and OSM are slowly but surely showing an increase in the number of objects mapped across the globe. As stated previously, due to the limited access to information from WikiMapia provider, this research has taken the development of OSM as representative of current VGI development in Indonesia.

According to the HOT Indonesia (2012) project report, in the OSM pilot study of implementation between June 2011 to March 2012, 163.912 buildings were mapped. HOT Indonesian's 2013 Annual Report records that 1.3 million buildings had been mapped. In other words, nearly four times the number of buildings were mapped in the period 2012-2013, than at the beginning of OSM operations (Figure 7.6). The number of buildings mapped by May 9, 2016 was 4,238,869 (Figure 7.7)



Source: Putten and Akhadi (2013), slide 37

Figure 7.6 Time Series of The Number of Buildings Mapped in Indonesia through the OpenStreetMap Platform



source: http://openstreetmap.id/data/osmstatsbar_id.html

Figure 7.7 Statistics of the Number of Buildings Mapped in The Territory of Indonesia by 9th May 2016

Strategies have been undertaken by HOT Indonesia for training OSM communities, including: basic and advanced training in building geo-databses in OSM; mapathons (face-to-face groups for building spatial object mapping); and OSM mapping and consultations through social media such as Facebook and Twitter. In an effort to increase the digitization of spatial objects mapped, HOT Indonesia held a mapping competition with rewards for members who mapped the greatest number of spatial objects.

In addition, other efforts at OSM community training were undertaken by HOT Indonesia. These included promotions to recruit new members by cooperating with government officials, schools and universities as well as civil society organisations such as the Scouts (*Pramuka*) and the Indonesian Red Cross (*PMI*).

Building the geo-database and training and recruiting new members of the OSM community continue to be effective, but according to interview respondents, voluntary digital mapping in Indonesia is still largely project-based even though it is the communities' own initiatives to identify the objects to be mapped in their areas. When the project was over, slow or stop participatory digital mapping progress occurred, due to no supporting budget for participatory mapping community empowerement. Also, less or no supporting budget will affect the awareness of local community to keep producing and updating spatial data, exception for particular persons who interest to produce and update spatial data and information. This is an existing deficiency the appropriate pattern in building awareness of digital mapping for communities of their own territory has not found yet.

7.2.6 Significant VGI stakeholders who need to be involved in success digital mapping community empowerment

The significant VGI contribution to build spatial database in Indonesia is owing to the substantial VGI stakeholder role in encouraging communities to map particular areas on the open source GIS platform. Shkabatur (2014) argues that there are four groups of stakeholders needed to achieve successful of interactive community mapping action globally: external interactive community mapping experts, local civil society organisations, local community members; and local public officials. However, drawing on observations, interview and HOT internal reports, the researcher identified five main stakeholders for creating successful VGI activities in Indonesia: international funders; HOT administrators/VGI organisers; local government; local organisation partners; and local mapping contributors.

International funders

Literally, Shkabatur (2014) mentions that international donors give attention regarding financing interactive community mapping operationalisation. However, she was not explicitly say that international donors become one of significant stakeholders to get the success of digital community mapping activities. The different argument with Shkabatur's idea, the researcher argues that international funders has a substantial role regarding VGI programmes in Indonesia. According to fieldwork and interview to one of the senior HOT Indonesian members, International funders or donors do not necessarily contribute to VGI initiatives, but their primary contribution is significant in creating a good atmosphere between governments and citizens.The case study of early OSM projects in Indonesia, the Australian Agency for International Development (AusAID) and the World Bank have supported local community mapping activities to fill the lack of official spatial data and information.

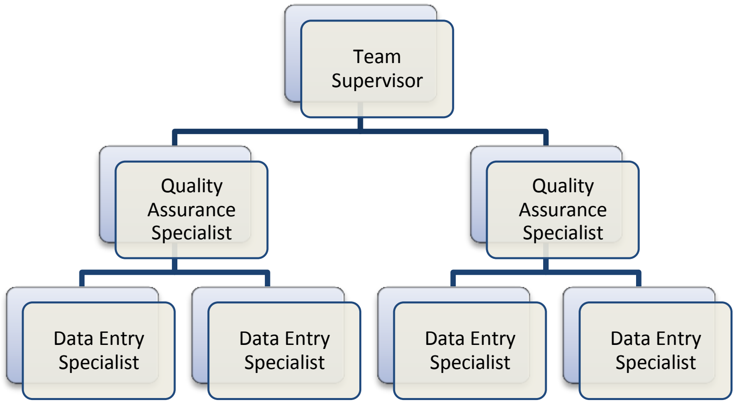
International funders have a critical part in bringing government on board, guaranteeing active backing for the undertaking, and organising and influencing the performance of all relevant partners. As the active engagement of government authorities bolsters the long-term producing and provision of official spatial data or information, it is imperative to guarantee coordinated efforts from the beginning of the VGI venture.

VGI organisers

In terms of Shkabatur's stakeholder criteria, VGI Organisers have similar context with external interactive community mapping experts. The generation of spatial data by a VGI community is ordinarily encouraged by civil society and VGI organisers. These organisers regularly have extensive involvement in configuring and creating VGI. HOT is one of the VGI organisers that works with the OSM platform and frequently initiates VGI procedures, endeavouring to extend their aptitudes and abilities in new areas. They normally contact a local civil society partner to gain an understanding of the needs and capacities of local communities and work with them on the outline and usage of the VGI procedure. These organisers then lead the VGI procedure, preparing group mappers to utilize mapping innovations, helping them to collect spatial data and information, and delivering relevant maps with appropriate symbols (legends) on the basis of the data and information collected.

In collecting spatial data in particular areas, VGI organisers will work in a structured way to obtain high spatial data quality. In general, VGI organisers include data entry specialists, quality assurance specialists and team supervisors. Data entry specialists are selected by recruiting local people who understand local geographic conditions of the area being mapped. Communities in this category do not require high skills in mapping or cartography, but their contributions will be subject to monitoring by Quality Assurance Specialist.

A quality assurance specialist is a VGI organiser responsible for selecting the quality of data that is mapped from a group of data entries. Members of this group are usually selected from local public figures who have knowledge of mapping and cartography. Lastly, the team supervisor is the highest position in the mapping structure, and has the role of final quality assurance before submitting digital spatial data to the global VGI portal (See Figure 7.8).



Created by the researcher in 2016

Figure 7.8 VGI Organisational Structure for Spatial Data Collection in OSM Procedure

Local government

In terms of Shkabatur's stakeholder criteria, local government have similar context with local public officials. Government advocacy of the VGI procedure and the cooperation of local authorities with VGI organisers, local organisation partners, and local community mappers are vital to secure the achievement and effects of VGI activities. Active government engagement to community increase opportunity that the resulting interactive mapping will be consistently guided to develop public services and other government programmes to community

Government responsibility for guiding public participatory in spatial planning may likewise guarantee support for the mapping procedure, increase the motivations of local inhabitants to take part in it, and enhance the financing of VGI. However, while the three partners— VGI organisers, local organisation partners, and local community mappers —are consistent elements of all VGI activities, the part of neighbourhood government and legislators shifts markedly from one VGI activity to the next. Organisation, leadership and political settings play significant parts in achieving VGI outcomes.

Local organisation partners

In terms of Shkabatur's stakeholder criteria, local organisation partners have similar context with local civil society organisations. Usually, independent VGI organisers work with local communities for a limited period, helping them to make volunteered geographic data and then leaving after the project contract is over. As VGI organisers are not embedded into the life of the areas being mapped, they have to work together closely with local organisation partners who are usually social groups and social activists who live and work in the area, for example, the Scouts (*Pramuka*), Red Cross (*PMI*) or local youth associations—who serve as the contact point for VGI organisers with the mapping group.

Participation between VGI organisers and local organisation partners is imperative in all phases of the VGI procedure. To start with, local organisation partners, local governments, or civil society activists can identify data needs and requests of the community and offer direction as to implementation in the specific local setting. At that point, local organiser partners can help by connecting with, and assembling, the community to participate in the VGI procedure, sorting out community discussions, activating enthusiasm to create spatial data or information on the open source GIS platform, recruiting mapping contributors, and supporting them through the mapping procedure. After fulfillment of the procedure, local organisation partners can serve as its "hosts," guaranteeing the utilization and further improvement of voluntary digital mapping guides.

Local mapping contributors

In terms of Shkabatur's stakeholder criteria, local mapping contributors have similar context with local community members. Like conventional community mapping, the centre of the volunteered geographic data procedure is the engagement of local inhabitants. The VGI procedure should give local inhabitants important specialized aptitudes, help them to speak to their communities and to the outside their areas, and increase their voice in regions that matter to them. While local occupants sometimes initiate the mapping procedure, more frequently, VGI is a supply-driven process, presented and supported by VGI organisers and local organisation partners. As already discussed, finding the right motivations is a testing assignment, as poor groups frequently do not directly benefit from the mapping exercise and cannot afford to volunteer for the undertaking without getting paid.

Facing the digital mapping problem, the researcher argues that building awareness of the benefits of geo-database built by community participation can be based on the theory of ‘communities of practice’ (Wenger, 1998). The community is aware of the benefits of community mapping for others outside the region and this contributes to establishing an external identity for the region. Each community member has a psychological connection to their homes, community and place, and benefits when these are recognized externally. In other words, public awareness of the importance of updating spatial data voluntarily through digital mapping occurs automatically when a community is able to show that mapping spatial data provides learning and helps form community identity.

In the long term, community willingness to engage with updating spatial data. Taken from Wenger’s Theory of Community of Practice ideas, the researcher argues if a community is homogeneous or having similar social and political backrgounds– then it is more likely to rapidly accept participatory interactive mapping in a VGI context. However, if a community in a particular place is heterogeneous or in a particular place where their communities have different social and political backgrounds–- it needs intensive communication over a relatively long time period to achieve consensus in similar social and political goals to make cooperation in performing consistent updating of digital mapping.

VGI provides great opportunities in describing spatial visualization for spatial planning applications through the provision of detailed and up-to-date spatial data for particular areas. However, as noted previously VGI activity is still being conducting on a project-by-project basis. It is feared after the project is over, the consistency to perform spatial data updating does not happen. In addition, citizen awareness of the ability to contribute to spatial data production still lacking.

As one of the senior HOT Indonesian organizers explained in an interview:

> *"Digital community mapping in Indonesia so far, is still on a project basis, and local community awareness of spatial data production participation is still very low. Until now, HOT Indonesia still has not found the right pattern in building a minimum awareness of digital mapping to a minimum for its territory. It could be expected,in the future, awareness of mapping will be embedded in each individual in the community so that they will engage in intense mapping or spatial data production."*

(HOT Indonesia Senior Management member: Interview at 6th February, 2015)

According to the interview, HOT Indonesia still has problems in finding a suitable method for building awareness of community digital mapping. With this in mind, the researcher attempts to explore the willingness of individuals in particular communities to participate in specific activites with the purpose of achieving community goals. The discussion in the next section explores community empowerment theory.

7.2.7 Community empowerment through VGI activities to support spatial planning process

Community empowerment or public participation in the spatial planning process has been discussed in Chapter 5, where it was suggested that one of the local community involvement methods in spatial policy processes is collecting data and information about their local areas. In this context, VGI becomes one these methods for data collection.

With the limited resources available, communities need decision-making based on understanding the importance of sustainability and the conflicts of interest that exist between the quality of life of a community (neighborhood); social, economic, environmental assets; and the potential benefits for different stakeholders in the decision taken. In principle, there must be a less distance bureaucracy between government and citizens at the level of participatory decision-making, but it also increases the intensive communications amongst stakeholders, including researchers, experts and policy makers.

Academicians can act as facilitators helping to identify local community needs as well as mapping local social issues through collecting data and analyzing the information on the VGI platform. At a later stage, their knowledge of local communities, the kinds of additional data needed and their ability to access data is a crucial contribution in a community.

In terms of citizen participation (see Chapter 5), the following kinds of spatial data and information can be collected to support the spatial planning process:
• Community inventory and asset evaluation;
• Social resources;
• Infrastructure resources;
• Environmental resources;
• Culture / history;

Currently, GIS applications are used extensively by citizens, individually or at local community level for involvement in spatial planning processes (these activities include collecting data, mapping, analysing and decision-making).

Participation in digitalized spatial data can be categorised in four degrees or intensities (McCall, 2004): information sharing, consultation, involvement, action.

1. ***Information Sharing***
One or two-way communication between 'outside' and local community involvement

2. ***Consultation***
Consultation is more like mentoring, directed to the key problems and the kinds of training needed by the community.

3. ***Involvement in decision-making by all actors***
Interaction between internal and external actors to identify priorities, analyze conditions, select alternatives and tools.

4. initiating Action
Independent initiatives driven by local communities who mobilize themselves to support relevant activities.

(McCall, 2004, pp. 5)

This does not imply that participation must always be of maximum intensity, but the intensity should be appropriate to the task, competence and the specific relationships between the actors participating in the spatial planning process.

The role of VGI in the spatial planning process has been examined by McCall (2004) who argues that the role of VGI as as a voluntarily mapping activity depends on the type of VGI community itself. The researcher argues that a local VGI community does have a direct impact on the policies made by the government, so spatial information visualization products created by a VGI community are more like the sharing information and consultation level identified by McCall. Communities directly affected by planning policies decided by the government are involved at Levels 3 and 4 - involvement in decision-making by all actors; and initiate action respectively.

The next section explores how government institutions use spatial data created by VGI communities to support spatial planning process.

7.3 Exploring VGI and Official Spatial Data Integration in Indonesia

In terms of urban planning in the digital age, globally, the trend has moved from the urban planning concept of the sustainable city to the so-called smart city. In simple interpretation, a smart city can be defined as a city that engages between governments, as the city authorities, and citizens through Information and communication technology (ICT) connections. A smart city is an urban area where information technology is used to address urban issues. Smart city concept has to understand encouraging data and information into software that can be seen in big screens to plan, monitor and evaluate development programmes then taking direct decision-makings (Townsend, 2013). Relevant to spatial data sharing in the smart city context, the new innovations offer complex conceivable outcomes to get to and exchange with applying the new innovation to a wide exhibit of spatial planning related applications, going from GIS to virtual city nets (Kunzmann, 1999).

At the central Indonesian government level, particularly in National Disaster Management Agency (BNPB) and the National Land Agency (BPN), spatial data are used for improving public services relating to public security and prosperity. BNPB and BPN have established the integration of official spatial data with spatial data created by VGI communities in the OSM platform. The findings of this research related to the integration of official spatial data with spatial data created by VGI communities in both these government institutions will be discussed in the next section.

7.3.1 VGI and official spatial data integration in BNPB

In accordance with Law No.26/2007 of Spatial planning, Indonesian spatial planning also involves responsibilities for disaster management. In supporting disaster management, the Indonesian government has established the Indonesian National Disaster Management Agency, *Badan Nasional Penanggulangan Bencana* (BNPB).

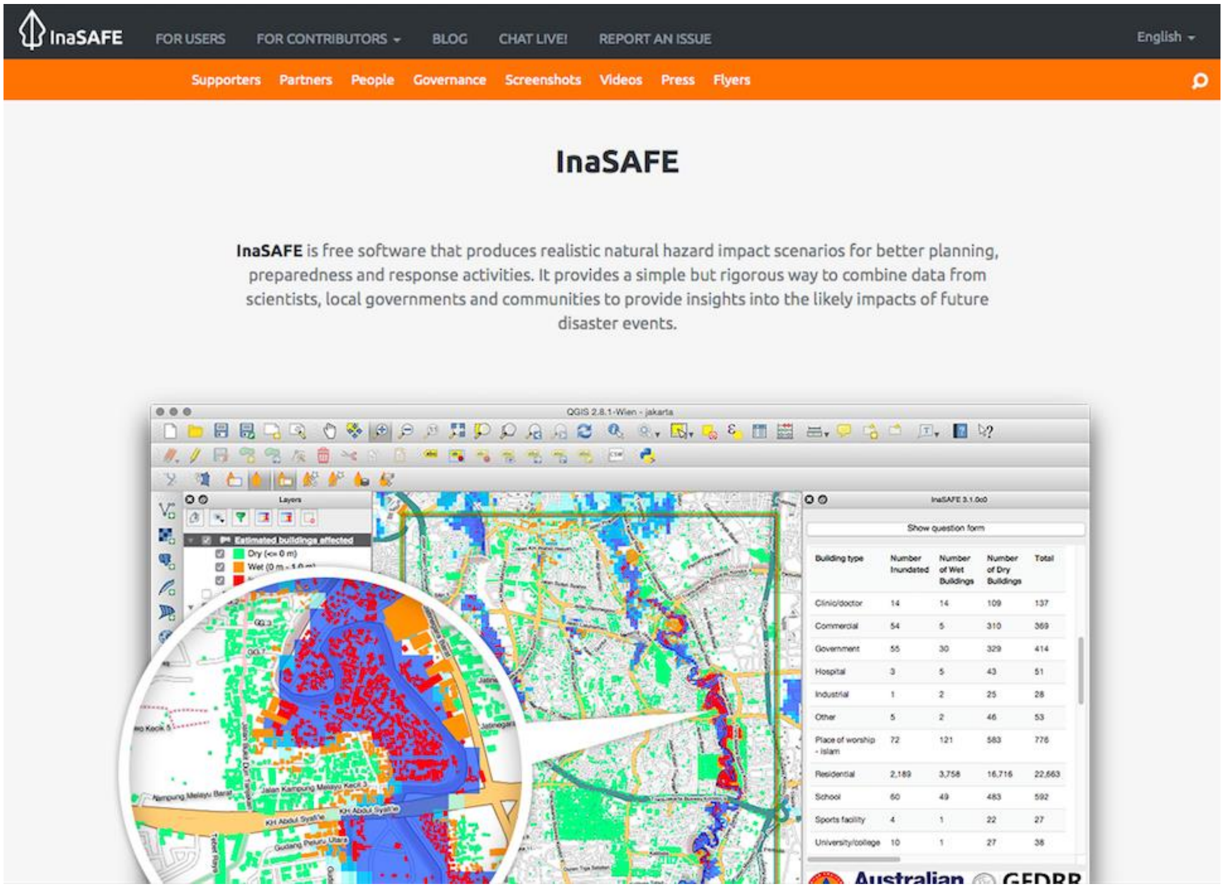
A priority of BNPB for identifying disaster-prone areas before, during and after a disaster is identifying quickly accessible relevant information in the existing data bases. Research for this thesis has revealed that before 2008, BNPB had experienced problems in presenting spatial information visualization for the identification of the regions of catastrophes, for instance, the lack of large-scale spatial data (ie. 1: 500, 1: 1,000, 1: 10,000) and the limited staff skills for creating and managing spatial data and information for disaster management purposes. One of the efforts related to spatial data procurement was collaboration with BAKORSURTANAL (former title of the Indonesian national mapping agency, now BIG), as the government agency with responsibilities for creating and organising spatial data and information. However, there were limitations on the ability of BIG to provide large scale spatial data for BNPB purposes.

The lack of spatial data management experiences in BNPB itself and the requirements of the Freedom of Information Act (Law. No. 14 of 2008, particularly Articles 10 and 11 relating to threats to citizens' lives), encouraged BNPB to collaborate with VGI organisers. VGI organisers were selected to work with BNPB on criteria relating to spatial data management capability, international recognition, and good organisational management with participation based process for large-scale spatial data provision. As a result, HOT Indonesian was selected as the Indonesian government partner.

Since 2012, BNPB has formed a partnership with HOT Indonesia, AusAID, the World Bank and the Global Facility for Disaster Reduction and Recovery (GFDRR) to develop the InaSAFE geo-portal that has functions for identification and analysis before, during and after disasters (See Figure 7.9 and http://inasafe.org.), InaSAFE provides a simple yet thorough method for combining data from scientists, governments and communities to provide information about the possible impacts of future disasters. The application is focused on a detailed calculation of the impact of threats in specific sectors. According to an interview with one of the senior HOT Indonesian organizers, InaSAFE is built for rapid reaction disaster emergency response.

> *"BNBP actually have access to BIG to collect spatial data, but they admit, when the event of a disaster occurred, BNBP had difficulty getting data and spatial information quickly. Thus, BNPB decided to make a geo-portal with a basemap that was established with the assistance of the OpenStreetMap community to conduct rapid reaction disaster emergency response, called InaSAFE."*

(HOT Indonesia Senior Management member: Interview at 6th February, 2015)



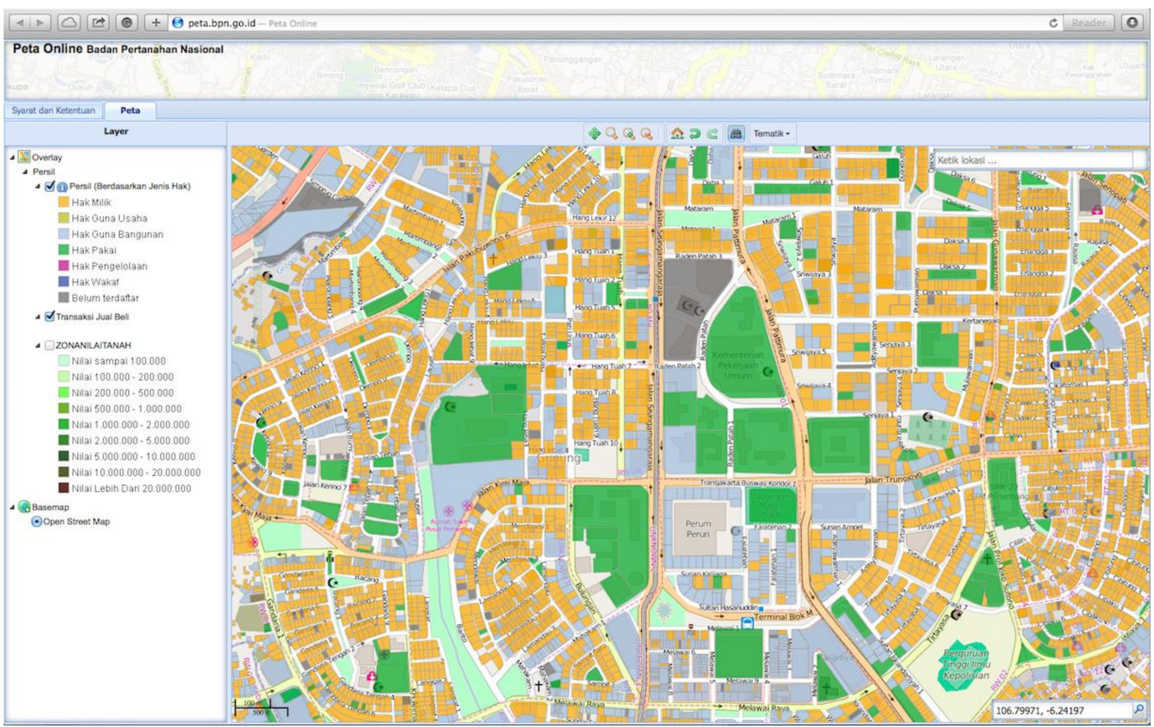
Source: http://inasafe.org

Figure 7.9 Inasafe Interface

The illustration above shows that in an emergency situation, BNPB as a government institution at the central level has integrated official spatial data with spatial data created from VGI sources. The natural disaster risk exposure of large scale spatial information visualitisation for disaster management purposes indirectly affects the decision making for planners in the spatial planning process to plan and develop central human activity areas in secure and safety areas from potential natural disaster effects.

7.3.2 VGI and the official spatial data integration in the Indonesian National Land Agency (BPN).

The National Land Agency (BPN) as the official government agency which manages land administration in Indonesia, which currently has merged with Directorate General of Spatial Planning from Ministry of Public Works into Ministry of Agrarian Affairs and Spatial Planning (ATR), provides a portal service presenting land use maps at a large scale that can be accessed everywhere (http://peta.bpn.go.id). The portal presents land status throughout Indonesia (ie. certificates of property rights or *Sertifikat hak Milik* (SHM), land rights certificates or *Sertifikat Hak Guna Bangunan* (SHGB), land parcel boundaries (*Petok*), and land use types). The portal shows the relative position of the distribution of plots. The BPN portal already uses spatial data created by the OSM community of Indonesia as the base map (see Figure 7.10).



Source: http://peta.bpn.go.id

Figure 7.10 BPN Land Geo-Portal Integrated with OpenStreetMap Spatial Data

Surprisingly, HOT Indonesia did not notice that BPN used their data without permission until a member of the OSM community pointed this out. According to an interview with one of HOT Indonesian Senior management member, spatial data built by OSM community is free to re-use by individuals or organisations, because OSM has an Open database License (OdBL). Individuals or institutions can use OSM data without HOT Indonesian permission, but the user should credit OSM in their portal.

> *"OSM international does not provide any requirement for individuals or organisations to use their data. OSM already has an open database license. (OdBL). In this OdBL, the user can perform spatial data downloads for private use/group without any conditions. But at least when issuing new portal products, they should list the sources of data obtained from OSM."*

(HOT Indonesia Senior Management member: Interview at 6th February, 2015)

A research respondent from middle management staff in Ministry of Agrarian Affairs and Spatial Planning (ATR) explained the reason for BPN using OSM spatial data is because parcel data generated by the OSM community have accurate and precise locations of plots compatible with the BPN database. In addition, OSM spatial data is frequently updated (once a month) compared with BPN, which for the official updating of data takes place periodically in line with government programmes and approval of the state budget for land spatial data updating by the Indonesian Legislature.

Through OSM, spatial data created by the VGI community and by BPN provides an opportunity to integrate the official spatial data with crowd-sourced geographic information in the spatial planning context.

7.4 Summary of Chapter

This chapter has attempted to answer the third research question: "How is spatial data created by citizens used in Indonesia?" by discussing the initiation, characteristics and development of public participation involved in the spatial data production and provision in Indonesia. Community participation in spatial data provision in Indonesia has various advantages as: an advocacy tool to gain recognition for local areas through negotiation with government; activities to identify spatial objects for the purposes of disaster management; and the fulfillment of the requirements for informal or recreational information such as cycling, tourist sites or restaurants.

A variety of participatory community-based activities with direct impacts on government policies and programmes in the planning of specific areas are the objects of current participatory research. In 2004, the Asian Development Bank (ADB) presented a comprehensive report on public participation in the decision-making processes which showed that participatory approaches in the spatial policy process provides efficiency and can accommodate all local community aspirations at low cost but with highly positive outcomes.

Many people are now voluntarily creating and sharing spatial data for specific purposes. So participatory mapping that was originally only accessible to limited communities, currently through interactive digital mapping, is also available to other communities outside of their areas so that they can map other regions.

Spatial data usage created by the OSM community in the BNPB and BPN examples reveals that government institutions at the central level already embrace opportunities for spatial data integration between official spatial data and spatial data created by VGI communities. To further understand the potential for spatial data integration between official spatial data and crowd-sourced geographic information generated by VGI in spatial planning processes at regional and local government levels, the two next chapters discuss spatial data management in government agencies at the provincial, regency and municipality levels, which are more developed regions in Chapter 8 and less developed regions in Chapter 9.

CHAPTER 8

SPATIAL DATA MANAGEMENT IN MORE DEVELOPED REGIONS

8.1 Introduction

This Chapter investigates issues concerning the characteristics of spatial planning, spatial data usage and spatial data development in selected areas with more developed governance regions as assessed by the *Kemitraan* NGO in 2012 and BIG history of GIS development (see Chapter 4). The case studies consider situations where there is active spatial data and information usage for spatial planning applications. These examples illustrate the resources (data applicable for sharing, human resources, technology, policy and organisation) necessary for creating the NSDI innovation model presented in Chapter 10.

This Chapter concentrates on three case studies in the political administration levels (*i.e.* province contains municipalities and regencies) of one political geographic area, namely, the Province of East Java, Surabaya Municipality and Bojonegoro Regency. The issue of particular interest is spatial data dissemination flows in between administrative levels from province to municipality and regency and *vice versa*.

This chapter is divided into six sections (including this introduction). The next three sections examine spatial planning and spatial data development in East Java Province, Surabaya Municipality and Bojonegoro Regency respectively. The fifth section explores existing spatial data dissemination at selected administrative levels, and the last section is the summary of the Chapter.

8.2 Spatial planning and spatial data management in the Province of East Java

This section discusses spatial planning and spatial data management in the Province of East Java. Specifically, it will explore aspects of SDI readiness under the Province government management and VGI development.

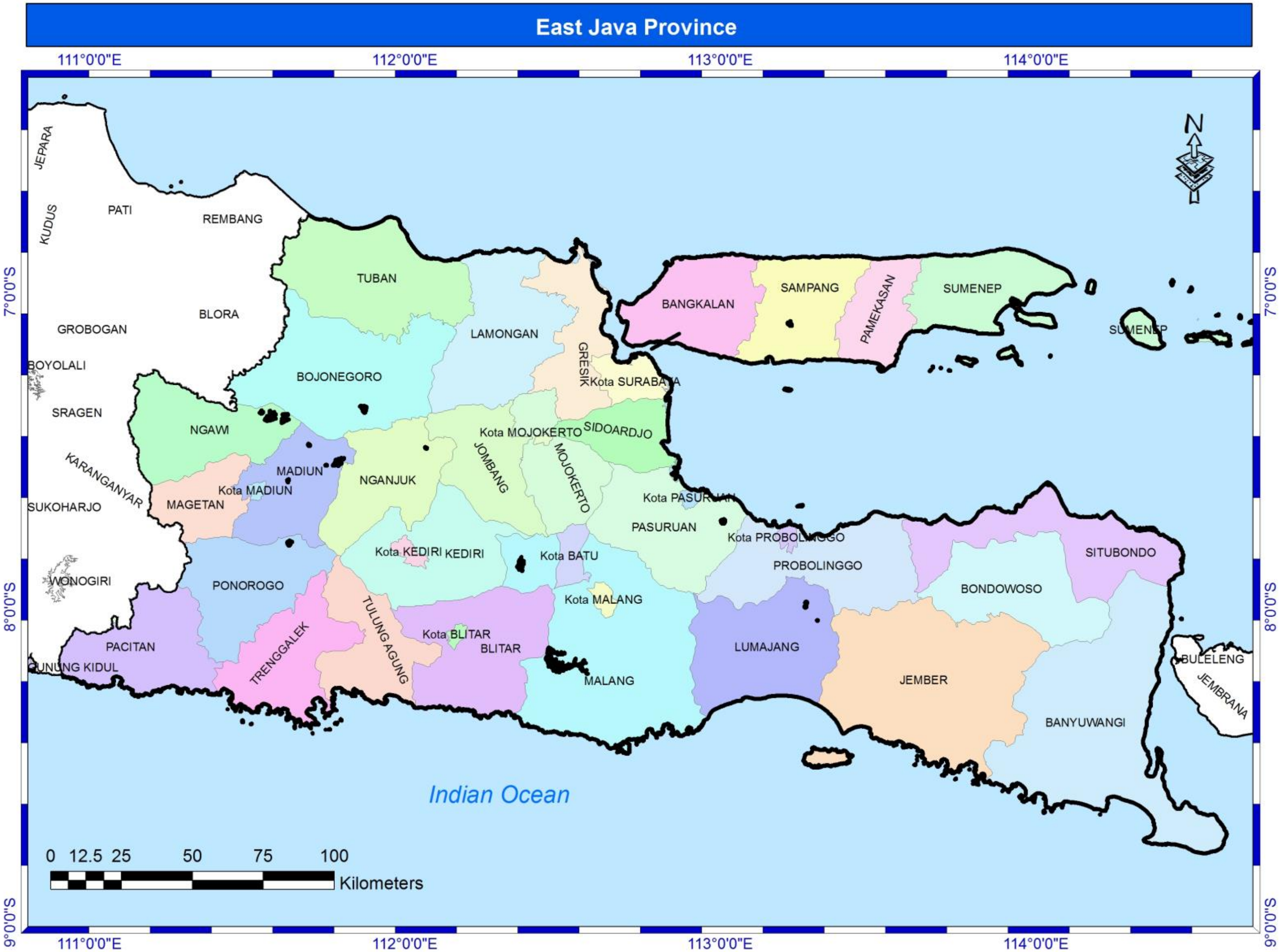
8.2.1 An overview of spatial planning in the Province of East Java

East Java is one of the provinces of Indonesia and is located in eastern Java Island. It covers an area of approximately 4,779,975 hectares divided into 29 regencies (*kabupaten*) and 9 municipalities (*kota*).

Geographically, East Java Province bounded by:

- to the North by Java Sea;
- to the East by Bali Strait;
- to the South by Indian Ocean
- to the West, the border with the Province of Central Java

(See Figure 8.1)



Source: BIG 2016, processed by the researcher

Figure 8.1 The Province of East Java

According to information obtained during fieldwork, the East Java Provincial Spatial Plan (RTRWP *Jawa Timur)* was enacted under the Province of East Java Regulation No.5 of 2012 for the planning period of 2011-2031. The spatial plan maps attached to the regulation have already obtained recommendation from BIG (See Chapter 5, Figure 5.9 for the provincial spatial planning procedure from proposal to enactment), The purpose of RTRWP *Jawa Timur* is realising the provincial spatial plan for high competitiveness and sustainability through the agropolitan and metropolitan development system.

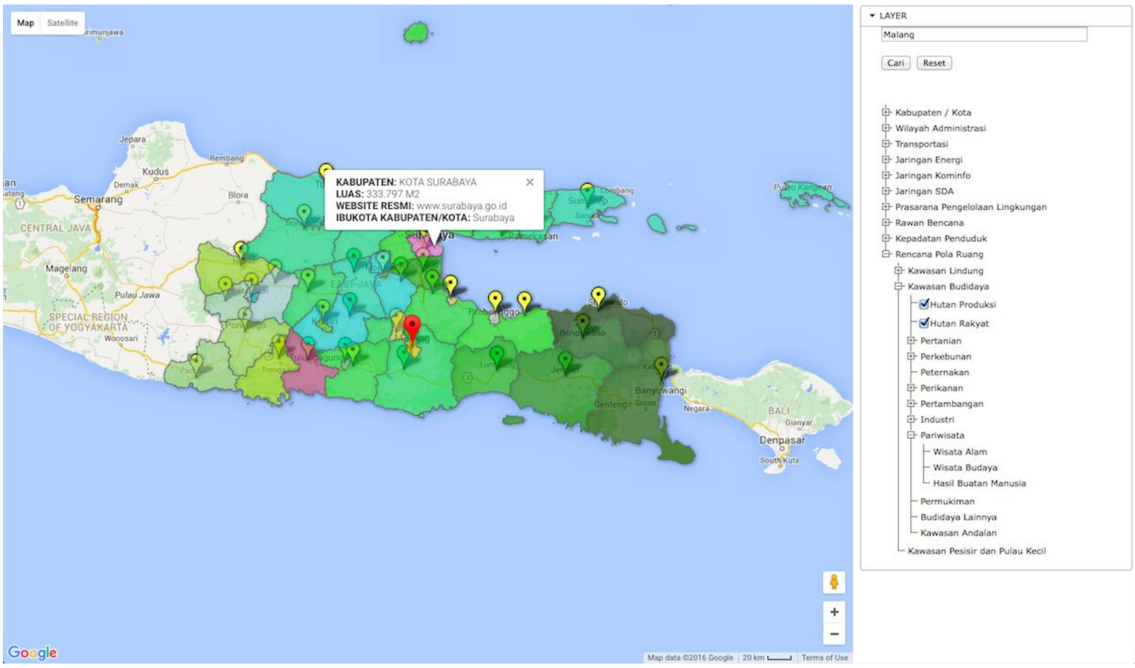
The Province of East Java coordinates the Provincial Development Plan and the Provincial Spatial Plan through the legislation of RTRWP *Jawa Timur* in accordance with sectoral policies in the National Long-Term Development Plan (RPJPN) and the Province of East Java Long-Term Development Plan (RPJP *Jawa Timur*).

The RPJP *Jawa Timur* aims to enable agribusiness consistent with the RTRWP *Jawa Timur* in the form of policies, strategies, spatial structure plan, land use plan, and strategic areas. So the RTRWP *Jawa Timur* already enhances the strategic spatial development plans of the policy directives contained in the RPJP *Jawa Timur*.

8.2.2 Spatial data usage for spatial planning activities in the government of the Province of East Java

To ensure that spatial planning activities work well, in 2014 the government of the Province of East Java formed the Province of East Java Regional Spatial Planning Coordinating Board (*Badan Koordinasi Penataan Ruang Daerah Provinsi*, BKPRDP). The *ad hoc* body was established to fulfil the mandate of the Ministry of Home Affairs Regulation No. 50 of 2009 of the Guidelines for the Regional Spatial Planning Coordinator. BKPRDP as an *ad hoc* body is made up of various provincial sectoral government services (*Satuan Kerja Perangkat Daerah*, SKPD) (i.e. Provincial Planning Board, Public Works, Department of Transportation, Department of Agriculture and Forestry Services). The BKRDP of the Province of East Java functions to synergise and match spatial planning in all regencies and municipalites under the Province of East Java authority.

The scope of coordination of the spatial planning areas includes planning preparation, land utilisation and spatial planning control. In supporting BKPRD activities, the *ad hoc* body has created the East Java Spatial Information System (*Sistem Informasi Tata Ruang Jawa Timur*, SITR JATIM) as the spatial information portal based on Geographical Information System. SITR JATIM is the Province of East Java spatial planning geo-portal which gives access to spatial planning information with the specific themes of spatial structure, land use and strategic areas for regencies and municipalities under the Province of East Java authority. Thus, SITR JATIM is the medium by which the Province of East Java government creates synergy and coherence planning and development agenda (See Figure 8.2).



Source: http://apps.lexion.co.id/sitr/jatim/beranda/peta_full/kosong

Figure 8.2 The Province of East Java SITR Portal

8.2.3 SDI under the Province of East Java government management

In order to realise spatial data development that is organised and managed in a structured and transparent way, and which can be integrated into a national spatial data network hub, branches of the spatial data network hubs need to be established (see Chapter 6, Section 6.6.4). This has a similar role to a spatial data custodian in organising spatial data and information through the collection, processing, storage, protection, use, management and dissemination of geospatial data and information following metadata (BIG, 2014b).

Based on the duties and authority of an institution responsible for managing spatial data and information, there are two types of network hubs: the central network hub; and the local network hub (BIG, 2014b). As discussed in Chapter 6, the central network hub is operated by Ministries and government agencies at the national level. The local network hub is operated by local government agencies at province, municipality and regency levels. The establishment of local spatial data network hubs is a part of the work of the Indonesian NSDI management. Therefore, the examination of SDI in each case study of this research will discuss the readiness for SDI by adopting the five pillars of NSDI (data, human resources, technology, organisation, policy) as elements of assessment.

The readiness of local spatial data network hubs was assessed by BIG and PPIDS UGM in 2013-2014. This is the Indonesian SDI Readiness Index (I-SRI) based on information from all provinces and several regency / municipality samples. I-SRI was conducted to assess local government readiness to use SDI for supporting the spatial planning process (Sutanta *et al*., 2014). I-SRI is comprised of four principal view points: institutional and policy perspective; human resources; technology, and data (Sutanta *et al*., 2014).

Each I-SRI component is made up of the following elements the institutional and policy component consists of three sub-categories: institutional setting, financial supports, and policy. The human resource component investigates the number of current staff, capabilities and professional development programmes. The technological aspect considers the availability of software and hardware. Finally, the data aspect assesses the accessibility and scope of dataset in local government (Sutanta *et al.*, 2014).

These components were weighted according to their priority value. Decision-making for assigning different weights to variables was led by group from the

Research Center for SDI Development (PPIDS UGM) alongside with BIG. The weighting formula is as follows:

> “[***I-SRI = 1.5 x institutional + 2 x human resources + 1 x technology + 1 x data***]”

The result is then standardised to get a final score on a scale of 1 – 100 (Sutanta *et al.*, 2014).

As discussed in Chapter 4, this research focuses on qualitative methods to assess the readiness for SDI at all levels. Thus, in this section, the review of the readiness of SDI environments the selected local governments (i.e. province, municipality and regency) adopts the I-SRI assessment by transforming quantitative methods into qualitative method by assessing whether a particular I-SRI component is 'available' or 'not available'. The detailed analysis of the readiness of SDI development is based on the in-depth interviews, observations and content analysis of the policies and internal reports.

According to the BIG and PPIDS UGM on I-SRI study, the Province of East Java ranks third best of all Indonesian provinces creating provincial SDI (See Appendix D). In examining what the BIG and PPIDS UGM did on I-SRI study, the details of SDI readiness assessment in the Province of East Java, the next section explores the five NSDI aspects of data, human resources, technology, organisation and policy from qualitative perspective.

Data

Data and standards assessment in the BIG and PPIDS UGM on I-SRI consists of three evaluation variables.

1. Availability of basic spatial data and related guidance of spatial planning activities, including base map, land parcel map, property tax map, spatial plan map, road network map and utilities maps.
2. The extent to which official spatial data that has been transformed and stored in digital format;

3. The amount of official spatial data/information published through the official website.

(source: BIG, 2014c)

The details of standards and data assessment aspects can be seen in the following table:

Table 8.1 Spatial Data Availability in The Province of East Java

No	Spatial data readiness aspect	Availability	Coverage areas
1	Topographic (*Rupabumi*) Map	Available	<50%
2	Land Parcel Map	Available	<50%
3	Land and Property Tax Map	Not available	0
4	Adminisrative Boundary Map	Available	50-100%
5	Spatial Planning Map	Available	50-100%
6	Detail Spatial Planning Map	Available	50-100%
7	Road Network Map	Available	50-100%
8	Urban and Regional Utility Map	Available	50-100%

Most official spatial data has not yet been transfomed into digital format.Some data has been digitized and published for the public, but data is uneditable format (JPEG) in the Province of East Java government official website

The table reveals that basic spatial data and information for the spatial planning process is already available and so is the thematic spatial data and information. Coverage has exceeded 50% of the total area of the Province, including a map of administrative boundaries, RTRW Map (General spatial plan), RDTR Map (Detailed spatial plan), transport / road network map and utility system map.

On the other hand, the availability of basic spatial data and information in the form of topographic maps and cadastral maps is below 50%, indicating that there is limited availability of basic spatial data and that this only covers a small area of the East Java Province. The I-SRI study shows that most of the spatial data and information in the Province government have not been stored on a digital database, whereas the public can access the digital spatial data format through the official provincial government website.

The survey for this research in February 2015 reveals that the spatial data for the Province of East Java already exists and could be accessed by the public. The scope of featured thematic spatial data that have been published consist of:

- Distribution of power generation at map scale of 1: 250,000;
- Distribution of gas pipelines at map scale of 1: 250,000;
- The distribution of clean water reservoirs at map scale of 1: 250,000;
- Distribution springs at map scale of 1: 250,000;
- The distribution of reservoirs at map scale of 1: 250,000;
- River networks at map scale of 1: 250,000;
- The road network at map scale of 1: 250,000;
- Distribution of soil types at map scale of 1: 250,000;
- Distribution of land cover at map scale of 1: 250,000;
- The district administration at map scale of 1: 250,000;

The available spatial data has been provided in http://geoportal.jatimprov.go.id/palapa_v2/web/peta. Even though spatial data in the province is accessible in large scale map (1:250,000), generally spatial data and information in the Province of East Java spatial database management are adequate. However, it is not require to national standards data types yet, hence, it needs to prepare spatial data standardisation and dissemination types consistent with national standards data types already released to create better governance in SDI.

Human resources

The human resources assessment in I-SRI study involves four variables

1. The number of staff able to operate GIS and manage spatial data;
2. The number of staff able to operate a geo-spatial server;
3. The educational qualifications of staff for operating GIS and handling spatial data and information.
   a. Learning GIS through independent study;
   b. Joining GIS courses / training;
   c. Graduates from Geodesy / Geomatics / Geography / Information Technology subjects;
4. Programmes to improve the personnel skills in the field of spatial data management and GIS with internet support

(source: BIG, 2014c)

The details of human resource assessment in the Province of East Java can be seen in the following table:

Table 8.2 Human Resource Capability to Manage Spatial Data and Information in the Province of East Java

No	Human resource readiness aspects	Availability	Note
1	Staff can operate GIS	Available	There are more than 5 staff who have GIS skills
2	Staff can operate a geo-spatial server (server with a publication and distribution facilities for spatial data and information)	Available	There are 2 staff who can operate a GIS server
3	Staff have educational qualifications in GIS, geomatics, geography	Available	The personnel who manage geospatial data have graduated from geography / geomatics / informatics subjects.

4	Government programmes aiming to improve the skills of personnel regarding spatial data and information management are available.	Available	GIS training is conducted to improve the skills of personnel

The I-SRI Report reveals that the human resource aspect of the Province government is very good in using and managing spatial data and information for the spatial planning process. More than five people can operate GIS and two people are able to operate a geo-spatial server).

Staff have acquires GIS knowledge and skills through formal education in geodetic / geomatics / geography, and other skills from independent study and courses / training on GIS. To improve staff performance in spatial data and information management, the Province government has included GIS training in its annual work programmes.

The survey for this thesis shows that some government personnel have knowledge and skills in managing spatial data and information. However, the system of personnel promotion and transfer to other work units means that the performance of data management and spatial information to run inconsistently (i.e. staff who are promoted/transferred aren't replaced with staff with similar skills). And, the replacement of personnel in charge by those with less GIS and cartographic knowledge will lead to a decline in spatial data and information management performance.

To maintain stability and good performance in spatial data and information management the Provincial government has sought an alternative by outsourcing the work to individuals and companies with qualified GIS and cartographic skills. However, outsourcing contracts may raise problems: The outsourcing employee payroll is included in the provincial government's work programme and does not always get approval from the Province of East Java Parliament (*DPRD Provinsi Jawa Timur*).

Technology

The technology assessment method in the I-SRI consists of eight evaluation variables:

1. GIS software (commercial or open source);
2. The hardware for geospatial data management and publication that includes: computers, servers, special room server and map server software;
3. Subscription to internet specifically for SDI server;
4. Geo-portal in operation;
5. Maps and geospatial information management catalogue system in hardcopy and softcopy format;
6. Public access to spatial data catalogue through internet;
7. Metadata enclosed alongside maps and digital spatial databases;
8. Metadata is used to compile the data catalogues;

(source: BIG, 2014c)

The details of technology assessment for the government of the Province of East Java can be seen in the following table:

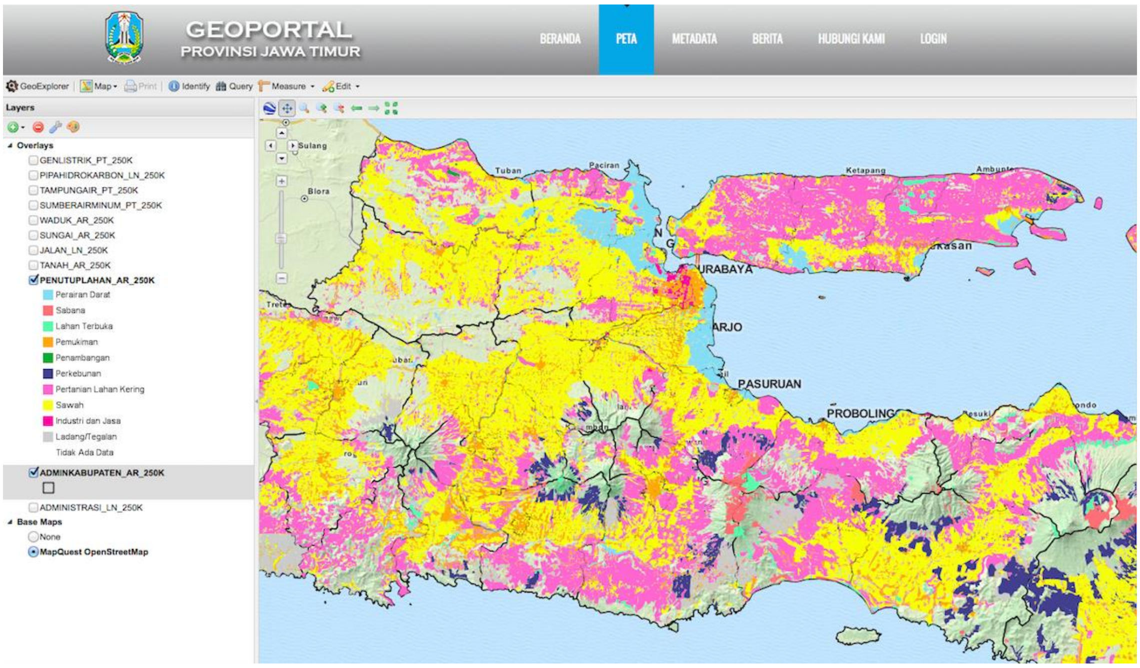
Table 8.3 Technology Capacity to Manage Spatial Data and Information in the Province of East Java

No	Technology readiness aspect	Availability	Notes
1	GIS Software	Available	Using GIS commercial software
2	The hardware for geospatial data management and publication		
	Personal Computer (PC)	Available	There are 3 PC units for spatial data and information management

	Server	Available	There are 2 servers
	Availability of special room for spatial data and information server	Available	
3	Internet subscriptions for supporting spatial data and information sharing activities	Available	Internet subscription with a bandwidth of> 3 Mbps
4	Geo-portal	Available	
5	Spatial data catalogue system	Not Available	
6	Availability of a spatial data catalogue online system	Not Available	
7	Metadata enclosed alongside maps and digital database	Not Available	
8	Metadata is used to compile spatial data catalogues	Not Available	

The I-SRI Report demonstrates that under the Province of East Java management the use of technology for building SDI is adequate. It is signified by the availability of GIS software, geo-portal, personal computers, servers, a special room for storage server and subscribes to the internet. However, it lacks of metadata to describe spatial data tracking record from productions until disseminations.

According to information from the research survey, facts about technology aspect lead the government of the Province of East Java to install multiple GIS software in computers. Existing servers for the storage of data and information related to the provincial government's tasks still combine spatial data and information types with other data types, such as numeric or texts. Therefore, spatial data sharing cannot achieve good performance due to mix data management other data types. The Geo-portal as the media for spatial data and information sharing had been created in the Governor’s office (See Figure 8.3)



source: http://geoportal.jatimprov.go.id/palapa_v2/web/peta

Figure 8.3 The Province of East Java Geoportal

Observation of the Province of East Java geo-portal reveals that it does not function well as a spatial data sharing medium, because it tends to function as WebGIS rather than spatial data sharing. The public who require spatial data provided by the provincial government can only download in raster format (JPEG, PNG or TIFF). Editing graphic format spatial data can only be done by actors who have authority, in order to to avoid the misuse of official spatial data.

Overall, the Province of East Java geo-portal has been integrated with the national geoportal in http://portal.ina-sdi.or.id. However, spatial data is not yet shared in the form of the standard national map. Therefore, there needs to be interoperability and standardisation of spatial data format to allowed sharing, so the essence of SDI can be realised in accomplishing successful Indonesian NSDI.

Organisation

The I-SRI assessment of the institutional aspect is comprised of two evaluation variables.

1. The coordination between institutions / committees for spatial data management, productions and utilization;
2. Availability of a special GIS unit.

(source: BIG, 2014c)

The details of the institutional aspects assessment in the Province of East Java can be seen in the following table:

Table 8.4 Organisation Capacity to Manage Spatial Data and Information in The Province of East Java

No	Organisational readiness aspect	Availability
1	Availability of a cross-agency coordination / steering committee for spatial data creation, management and utilization	Available
2	Availability of a special GIS unit	Available

The I-SRI Report indicates that the institutional aspect of the Province of East Java SDI is adequate. It is characterized by the availability of coordination amongst institutions, and there is a special unit that handles spatial data management.

According to information gained in the research survey, the Province of East Java government has established a spatial data network hub that consists of some the provincial government services, including:

- Transportation services;
- Communication and Informatics services;
- Public works services;
- Environmental services;
- Tourism and culture services;
- Energy and mineral resources services;
- Forestry services;
- Agriculture services;
- Fisheries and marine affair services.

The provincial spatial data hub is responsible for collecting, maintaining and updating spatial data, creating metadata, and disseminating spatial data and metadata to the clearing units which are coordinated under BAPPEPROV Jawa Timur, the Provincial Planning Board (*Badan Perencanaan dan Pembangunan* , BAPPEPROV). On the other hand, field observation indicates that there is no consistency between government services or commitment to performing a role in building and sharing spatial data. This information can be obtained due to the following factors:

- Spatial data and information management is not priority of government service sectors ;
- Much spatial data is managed in hardcopy format;
- Infrastructure to facilitate spatial data exchange and sharing is lacking;
- Staff capabilities for managing the exchange and joint use of spatial data are lacking.

Policy

The I-SRI method of assessment of the policy aspect has seven evaluation variables:

1. SDI development plan;
2. Implementation of Indonesian National Standards (SNI) ot technical specifications determined by Ministry / agency;
3. The mechanism for data access;
4. The mechanism of licensing arrangements and the use of spatial data rights protocols;
5. Regulations by the Governoor / Regent / Mayor related to spatial data usage and management;
6. SDI implementation related to the availability of spatial data, systems, and connection to the Internet: procurement of spatial data, procurement systems, and Increased competence / qualifications of human resources in the field of geospatial information through training / courses;
7. Financial support in the form of local or central government budget.

(source: BIG, 2014c)

Details of the assessment of policy aspects in the Province of East Java can be seen in the following table:

Table 8.5 Policy Support to Manage Spatial Data and Information in the Province of East Java

No	Policy readiness aspect	Availability	Notes
1	There is a strategic plan or roadmap for development of SDI	Not Available	
2	Spatial data management has followed the Indonesian National Standards (SNI) or technical specifications determined by the Ministry / agency	Not Available	

3	There are formal mechanisms for spatial data sharing between government institutions	Available	
4	There is a regulatory mechanism for authorizing spatial data utility for public	Available	
5	There is a regulation related to the spatial data utility and management	Not Available	
6	There is a Governor regulation concerning utilization and management of spatial data	Available	

As already mention in the last component of I-SRI method of assessment of the policy aspect, financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization. The financial support for SDI operationalization in government agencies consists of data, software and hardware procurement, maintenance and internet subscription. Details of the financial assistance of SDI operationalization in the Province of East Java can be seen in Table 8.6.

Table 8.6 State Budget Support to Manage Spatial Data and Information in the Province of East Java

No	Activity	Budgeting system			
		Routine		incidental	
		APBD	APBN	APBD	APBN
1	Spatial data procurement			✓	
2	Computer System Procurement			✓	
3	Maintenance / updating spatial data	✓			
4	Metadata procurement (information about spatial			✓	

	data)				
5	Computer system maintenance / development			✓	
6	Internet subscriptions for spatial data sharing activity	✓			

The I-SRI Report indicates that the policy aspect in the province government does not show decisiveness in managing spatial data sharing. It can be seen from the following facts.

- It lacks of SDI development strategy;
- Spatial data management does not follow the technical specifications set out in national standards;
- It lacks regulation related to spatial data utility and management.

According to information obtained from fieldwork observations, the Province government issued the Governor of East Java Regulations No. 23 of 2010 for the regional spatial data network hub. The regulation appointed provincial sectoral government agencies to become custodians for the provincial SDI.

Overall, the regulations created by the Province of East Java government do not explicitly concern the policy and technical aspects of the relationship between government services regarding spatial data sharing. Therefore, the lack of attention to policy issues needs immediate regulations pertaining to spatial data sharing in order to achieve spatially enabled government and the success of the Indonesian NSDI.

8.2.4 VGI performance in the Province of East Java

As already discussed in Chapter 7, the development of spatial database activities by VGI communities in Indonesia is dominated by OSM, and is mainly aimed at digitising road networks, land use or building parcels for the purpose of disaster mitigation activities.

According to the research fieldwork, spatial database development activities by OSM communities is mostly conducted by the citizens involved in a particular community organisations, such as the Scouts (*Pramuka*), the Indonesian Red Cross (PMI) or youth organisations. An example is the an interactive VGI mapping activity in 2013 in the Province of East Java which was conducted along the Bengawan Solo River that passed through five districts, namely Ngawi, Bojonegoro, Tuban, Lamongan and Gresik (HOT, 2014) (see Figure 8.4). This spatial database built by VGI community for East Java was coordinated by the Province of East Java Regional Disaster Management Agency (Indonesian: *Badan Penanggulangan Bencana Daera*h, abbreviated as BPBD).

Source: OSM Report 2014

Figure 8.4 The Scope of Participatory GIS Activity by OSM Communities along the Bengawan Solo River

The basic disaster mitigation mapping along Bengawan Solo River was digitised general spatial features of the communities whose areas were affected by the flooding. Another interactive VGI community mapping activity in the Province of East Jave province was mapping exposures to risks and hazards in Sampang, Situbondo, Malang and Trenggalek.

The disaster mitigation mapping undertaken by the OSM community is used as the basis for planning mitigation as part of the preparation of the provincial spatial planning process. In general, the characteristics of spatial database development conducted by OSM communities in East Java Province are essentially still project-oriented to targeted areas selected in accordance with government projects. Thus, the development and updating of spatial databases is not systematically carried out.

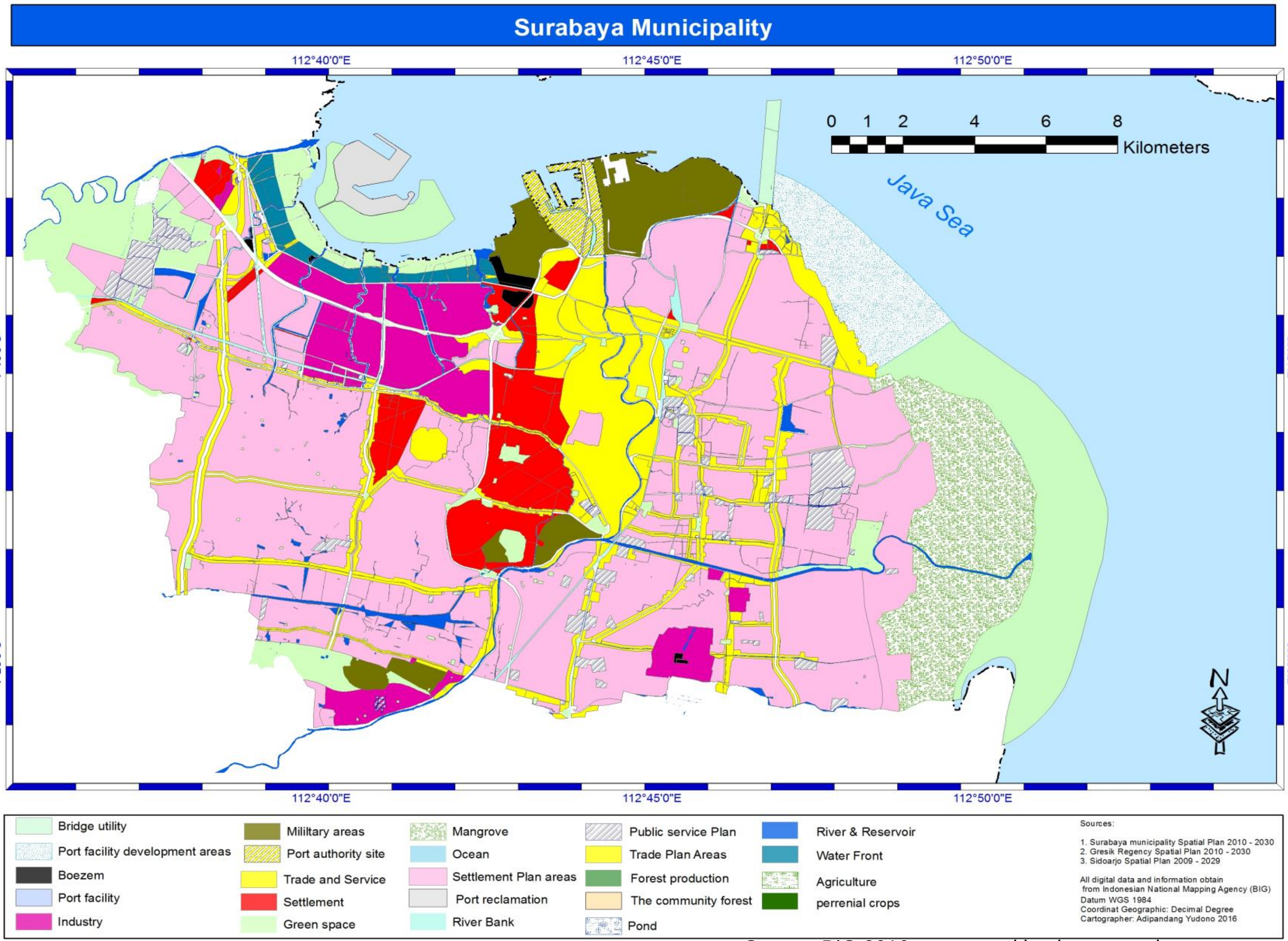
The public participatory planning processes discussed in Chapter 6 and the characteristics of VGI in Indonesia described in Chapter 7 demonstrate that Indonesia generally lacks public participation in the development of spatial data and information sharing. Spatial database development by the OSM community of the Province of East Java is conducted by members of voluntary organisations, because their activities are directly relevant to natural disaster mitigation.

8.3 Spatial planning and spatial data management in Surabaya Municipality

This section discusses spatial planning and spatial data management in Surabaya municipality. Specifically, it examines SDI readiness for spatial data development in this region under municipality government management and VGI development in Surabaya.

8.3.1 An overview of spatial planning in Surabaya Municipality

Surabaya is the capital city of East Java Province. Most of its territory is low lying with a height of 3-6 meters above sea level, while the southern part is hilly with a height of 25-50 meters above sea level (See Figure 8.5). The total area of Surabaya municipality is 52,087 ha, with land areas of 33,048 hectares or 63.45% of the municipality area and water areas of approximately 19, 039 hectares or 36.55% of the area.



Source: BIG 2016, processed by the researcher

Figure 8.5 Surabaya Municipality

According to information from the research fieldwork, the Surabaya Municipality spatial plan (RTRW Surabaya) has already been ratified by Surabaya Municipality Government Regulation no.12 of 2014 for the planning period of 2014 - 2034. However, there was a discrepancy in the procedure of Surabaya RTRW enactment. According to Law No.26 of 2006, Article 14, Paragraph 7, Government Regulation No. 8 of 2013 and the Head of BIG Regulation No. 6 of 2014, the product of spatial planning should be attached spatial plan maps which have received a recommendation from BIG (See Chapter 5, Figure 5.10 for the municipal spatial plan enactment procedure).

However, the legally approved Surabaya Municipality Spatial Plan does not have attached spatial planning maps. Analysis of the Surabaya spatial plan documents revealed that the consultation undertaken by the municipality government in 2016 for the spatial plan maps is under discussion with BIG, and the regulations for the thematic maps have not yet been drawn up.

Further insight into this discrepancy in the approval procedures for the Surabaya Municipality Spatial Plan was gained through: interview with one of the senior management staff of the municipality government; content analysis of the policies; and internal reports of the spatial plan process. Two main points can be made: 1) the pressure from central government to immediately approve RTRW Surabaya revision follows the new rules after the promulgation of Law. No. 26 of 2007; 2) reaching a political compromise during discussion of the spatial plan caused a long delay, including changing technical aspects (e.g. changing spatial visualisations from paper-based map into digital spatial information format) and the content of the Surabaya spatial plan maps.

For the first point, the enactment of the new spatial planning Law No.26 of 2007 meant that all municipalities and regencies in Indonesia are required to revise their existing spatial plans within a minimum period of three years after the passing of the new law on spatial planning. Previous spatial planning in Surabaya was established under the Surabaya Municipality government regulation No. 3 of 2007 made under Law No. 24, of 1992 which the 2007 law suspended.

The second point was the political compromise over the spatial plan discussion which caused a long delay in producing the Surabaya Municipality spatial plan maps. In addition, the face-to-face consultation between bureaucrats over the approval of planning maps in the BIG headquarters office also takes time for approval process.

The political compromise over the Surabaya Municipality spatial planning process, especially debating land use plans to determine on official spatial plan maps, is inseparable from the limited amount of urban space available for the multiple actors in municipality development. Involving investors / capitalists (entrepreneurs), the state (government) and the public (including environmental NGOs). Therefore, conflict and contestation between actors in spatial planning practices cannot be avoided. This is in line with the idea of Dühr (2007),

> *"There is a strong relationship between plans and cartographic representations and the planning discipline. Clearly, maps, plans, sketches, images or other cartographic representations are (besides language) the most important communication medium for planning, as only they are able to clearly visualize the complexity of different demands on space."*

(Dühr, 2007, pp. 32)

To anticipate the immediate needs of the Surabaya Municipality planning and development agenda, the municipality government sought out legal alternative procedure by enacted the spatial planning map set under the Surabaya Mayor Regulation No. 4 of 2016 for the production of a detailed Surabaya municipality spatial plan map (See Figure 8.6).

Analysis of the Surabaya Mayor regulatory provisions for the detailed Surabaya Municipality Spatial Plan map ratifications shows that there were three Mayoral amendments to the regulation from 2014; firstly, the Surabaya Mayor Regulation No. 42 of 2014 (before the enactment of legislation of Regulation Government No.12 of 2014); Secondly, the Surabaya Mayor Regulation No. 56 2015 (after Regulation Government No.12 of 2014 was ratified); and lastly, the Surabaya Mayor Regulation No. 4 2016 (when Regulation Government No.12 of 2014 had been validated).

The Surabaya Mayor Regulations had been amended twice after the establishment of Regulation No.12 of 2014 due to the political compromise pertaining limited urban space utility. Added to this, the revision of the spatial plan maps is still being discussed under BIG supervision.

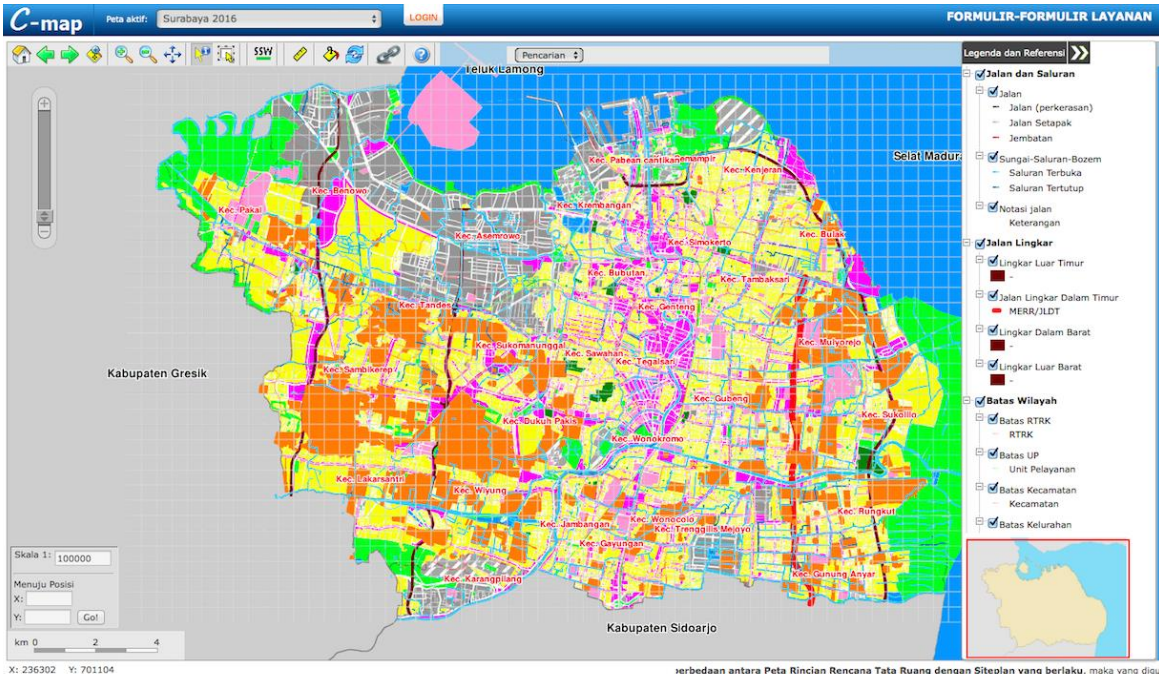
The fact that the Surabaya Municipality Spatial Plan was ratified without the spatial plan maps attached demonstrates that the role of spatial data and information has not been considered significant in spatial planning law. Thus, local government needs guidance and supervision for using spatial data and information in spatial planning. Also, there is a need for innovation in the consultation procedures over spatial plan maps with BIG via e-consultation mechanisms. The use of e-consultation of spatial plan maps would reduce the bureaucratic procedures for technical spatial plan maps consultation and speed up recommendations from BIG to support spatial planning ratifications.

Source: The Surabaya Mayor Regulation No. 4 of 2016 with permission to re-print from Government of Surabaya Municipality

Figure 8.6 The Detailed Surabaya Municipality Spatial Plan Map according to the Surabaya Mayor Regulation No. 4 of 2016

8.3.2 Spatial data usage in Surabaya Municipality government

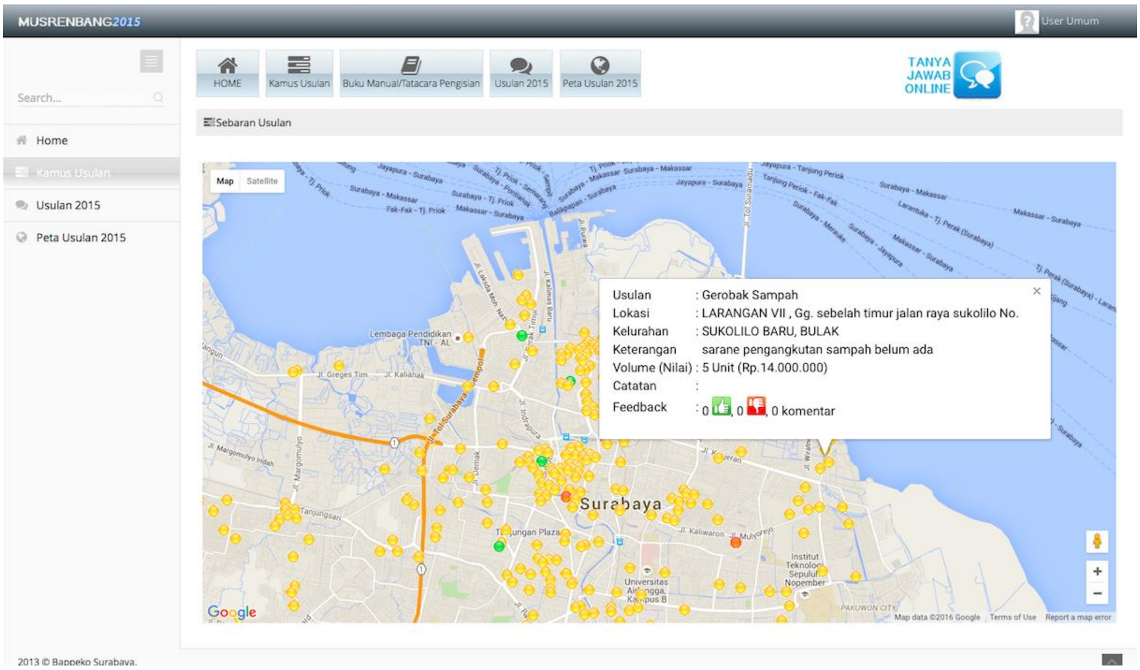
In terms of spatial data usage for spatial planning, the government of Surabaya Municipality, specifically the Surabaya Municipality Planning Board (*Badan Perencanaan dan Pembangunan Kota Surabaya*, BAPPEKO Surabaya) has developed WebGIS to make land use planning information available to the publics (See Figure 8.7); however, it can only be downloaded in raster format (JPEG). Meanwhile. To prevent misuse, spatial data editing is carried out by authorised government actors (Interview, senior management staff, BAPPEKO Surabaya).



source: http://petaperuntukan.surabaya.go.id/cktr-map/

Figure 8.7 Surabaya Municipality Land Use Planning WebGIS

To achieve good governance in spatial planning processes, the municipality government has developed electronic participation (e-*musrenbang*) to accommodate public needs for creating better quality living places (See Figure 8.8).



source: http://bappeko.surabaya.go.id/musrenbang2015/#

Figure 8.8 Surabaya Municipality e-*musrenbang* Platform

The e-*musrenbang* platform utilises spatial data and information for the analysis of development and planning. The application shows that the municipality has applied spatially-enabled government for dialogue with the public. To explore the readiness of Surabaya Municipality to establish SDI, the next section discusses five aspects of SDI assessment of the municipality's spatial data management

8.3.3 SDI under Surabaya Municipality management

According to information from the research fieldwork, Surabaya Municipality was not recorded in the I-SRI study. This is confirmed by one of the senior management staff of BAPPEKO Surabaya (Interview, 2015). Thus, during interview, the researcher initiated to gain SDI readiness performance information by informal interview and distributed questionnaire with same format with the Province's I-SRI method assessment of using "Available" and "Not Available" categories for each I-SRI component.

Data

In the case study of Surabaya Municipality, most of spatial data has transformed into a geo-referenced digital format. However, spatial data published for public use on the Surabaya Municipality official website only allows display of data and downloading is not possible. The availability of basic spatial data and guidance/guidebook for spatial planning activities details can be seen in the following table:

Table 8.7 Spatial Data Availability in Surabaya Municipality

No	Spatial data readiness aspect	Availability	Coverage areas
1	Topographic (*Rupabumi*) map	Available	100%
2	Land parcel map	Not Available	
3	Land and property tax map	Available	<50%
4	Administrative boundary map	Available	100%
5	Spatial planning map	Available	100%
6	Detailed spatial planning map	Available	50-100%
7	Road network map	Available	100%
8	Urban and regional utility map	Available	100%

The answers to the research questionnaire indicate that the basic spatial data and information for the spatial planning process in the municipality government are adequate. In general, the thematic spatial is has 100% coverage of the total Surabaya area, including the base map, the administrative boundary map, Surabaya Spatial Plan maps, transportation/road network map and urban infrastructure map.

However, as shown in the Table, the availability of land and property tax maps was still under 50%. A cadastral map is not available, because it is created and fully owned by the Indonesian National Land Agency (BPN).

The fieldwork study indicates that spatial data and information in the municipality has stored in a digital geo-referenced format. The overall spatial data in the form of spatial data vector data is provided in shapefile (.shp) format that already has geographic coordinate information.

> *"Since the Law No.26 of 2007 of Indonesian spatial planning was enacted, the RTRW Surabaya underwent an update with the enactment of Regulation No.12 2014. In the law, the existing technical spatial planning guidelines have been provided, including spatial plan mapping, which is still in discussion with BIG. We consulted to BIG up to 3-4 times over the form of synchronization with GIS coordinates. Thus, with the new law, the preparation of Surabaya Spatial Plan mapping is already in the form of digital mapping in shapefile."*

(BAPPEKO Surabaya Senior Management Staff; Interview at 27th February 2015)

Based on observations in February 2015 of data readiness for SDI development in Surabaya, the spatial data has been provided for spatial information display to the public. The published thematic features cover:

- road network map at scale 1:5000;
- drainage network map at scale 1:5000;
- administrative boundary map at scale 1:5000;
- landuse map at a scale 1:5000;
- coastal and building buffer zone map at scale 1:5000;
- Satellite imagery of 10 m resolution covering all Surabaya Municipality area;

Human resource

The assessment of human resources readiness questionnaire for the Surabaya Municipality was similar to that for the Province of East Java. The details can be seen in the following table:

Table 8.8 Human Resource Capability to Manage Spatial Data and Information in Surabaya Municipality

No	Human resource readiness aspect	Availability	Note
1	Staff capability to operate GIS	Available	8 staff have GIS skills
2	Staff able to operate geospatial server (server with a publication and distribution facilities of geospatial data and information)	Available	Personnel who have the ability to operate GIS also have the capability to operate the GIS server. So, there are 8 personnel can operate GIS server
3	Staff having educational qualifications in GIS, geomatics, and geography	Available	The personnel who manage geospatial data have graduated from geography / geomatics / informatics subjects.
4	Government programmes aiming to improve the quality of personnel regarding spatial data and information management	Available	The programme to improve the quality of personnel is conducted through GIS training

The answers to the questionnaire carried out during fieldwork indicate that the human resources in the municipality government in utilising and managing spatial data and information for the spatial planning process are very good. The assessment showed that 8-10 personnel are capable of operating GIS and a geo-spatial server; and they are able to use and manage data and information for the spatial planning process.

Like to the Province of East Java, their GIS knowledge and skills acquired through education, especially from geodetics / geomatics and geography qualifications. Other skills are obtained through GIS courses / training. Furthermore, in improving spatial data and information management performance, the municipality has involved spatial data and information development training in its annual work agenda.

All BAPPEKO Surabaya's staff undertake many administrative tasks unrelated to spatial data management. So, activities/programmes related to digital spatial databases are sometimes handled by third parties, such as professional consultants or academcs.

> *"In BAPPEKO Surabaya, there is no special unit focusing on spatial data processing, all units must work in multiple job desks. In other words, this database included the drafting work with programmes for other activities in Bappeko. Thus, for the activities that specifically address the digital spatial database, sometimes hired experts outside the institutions, such as professional consultants or academics."*

(BAPPEKO Surabaya Senior Management Staff; Interview at 27th February 2015)

Overall, human resources in charge of SDI in Surabaya Municipality government management are adequate.

Technology

The format of the review of technology readiness questionnaire was also similar to the Province of East Java assessment. Details can be seen in the following table:

Table 8.9 Technology Capacity to Manage Spatial Data and Information in Surabaya Municipality

No	Technology readiness aspects	Availability	Notes
1	GIS Software	Available	Using GIS commercial and open source software
2	Hardware to support spatial data and information management		
	Personal Computer (PC)	Available	There are 3 PC units for spatial data and information management
	Server	Available	There are 2 servers
	Special room for spatial data and information server	Available	
3	Internet subscriptions supporting spatial data and information sharing activities	Available	Internet subscription with a bandwidth of> 3 Mbps
4	Geo-portal	Not Available	
5	A spatial data catalogue system	Not Available	
6	An online spatial data catalogue system	Not Available	
7	Metadata used to compile spatial data catalogues	Not Available	
8	Metadata used to compile spatial data catalogues	Not Available	

The information from the questionnaire carried out during fieldwork reveals that Surabaya Municipality has adequate technological supports for the spatial planning process. The availability of GIS software, personal computers, servers, a special room for the servers and subscriptions to the internet are clear evidence of the adequacy.

The research survey shows that the municipality has installed some GIS software in their computers that are used to manage spatial data. They also have a server functioning as data and information storage related municipal government tasks. At the moment, BAPPEKO Surabaya is developing the Surabaya Integrated Planning System (SIPS). SIPS is a portal to support all planning in relation to all aspects of development run by the Surabaya Municipality. It is an information system that can process geographic information as a basis for spatial planning analysis. This also improves the function of paid-GIS application that is not used optimally by the public. It is free and user-friendly. SIPS users, i.e. BAPPEKO and other official services, do not need to have special expertise in the field of geomatics or geography to be able to operate it.

> *"Currently, BAPPEKO Surabaya is developing the Surabaya Integrated Planning System (SIPS) geo-portal. With this portal, all information about Surabaya, such as social, economic and physical aspects can be displayed spatially. Given this SIPS, then the urban conditions could be monitored by the municipal government, such as for infrastructure, be able to know the distribution of damaged roads. "*

(BAPPEKO Surabaya Senior Management Staff; Interview at 27th February 2015)

Preparation for SIPS began in 2014 and it was planned to present all spatial data and information (social, economic and physical matters) in a comprehensive spatial visualisation. However, as there is too much information to display (over-data), and launching has been postponed until 2017. Currently, efforts to simplify the portal are already underway, so in future, it will be more user-friendly. SIPS development is directed to structuring its accessibility so it can be used by all Surabaya’s government services and integrated with the Surabaya Government Resource Management System. Thus, the principle of "One Map Reference" and integrated plans can be realized.

Organisation

The details of questionnaire of the assessment of institutional aspects of readiness for SDI in Surabaya municipality can be seen in the following table:

Table 8.10 Organisation Capacity to Manage Spatial Data and Information in Surabaya Municipality

No	Organisational readiness aspect	Availability
1	A cross-agency coordination / steering committee for spatial data creation, management and utilisation	Not available
2	A special GIS unit	Not available

The questionnaire results indicate that the institutional aspect of Surabaya Municipality SDI is not yet ready. Coordination amongst institutions is not available, and no special unit handles spatial data management.

Based on fieldwork information, it seems that until now, government services related to spatial interaction (e.g. transportation, fisheries and sanitation) are not familiar with spatial data and information analysis. The government services in Surabaya that commonly perform spatial analysis are only the Public Works Agency and BAPPEKO Surabaya. Any of the municipal sectoral services requesting digital spatial data, such as a shapefile format for official purposes, must write to the Head of BAPPEKO Surabaya and the request must be signed by the head of that authority and eventually, spatial data will be given in digital format. This situation occurs due to the nature of digital spatial data, such as shapefile format, which can be edited. Since BAPPEKO Surabaya is worried about the possibility of data changes, it asks the requesting authorities to clarify their purpose.

"In current conditions, most of the SKPD [Surabaya's government sector units] in Surabaya are not familiar with spatial data. Usually, spatial analysis is performed by the Public Works Agency and BAPPEKO itself. If one of the SKPD requests spatial data, then, Bappeko will ask the area of interest [AOI] where they are required, and then BAPPEKO will map the area according to the request then the give it in JPEG format. However, if SKPD requires editable spatial data or shp format, then the SKPD should apply with an official letter to the Head of BAPPEKO, then, if the Head of BAPPEKO agrees to give in shp format, then BAPPEKO will give it."

(BAPPEKO Surabaya Senior Management Staff; Interview at 27th February 2015)

The organisational readiness assessment in building SDI cannot be separated from the leadership aspect. The results from the fieldwork reveal that all leaders in all Surabaya government services, from Mayor to Heads of sectoral government services, have agreed to the application of data sharing. However, sometimes there have been different perspectives regarding spatial data sharing at the top level of government authorities, such as the provincial and national levels. Therefore, spatial data sharing at Surabaya Municipality level is not integrated with central and province levels. Furthermore, according to field observations, there is little consistency between each governmet service to a commitment in performing its role to build and share spatial data. This is due to the following factors:

- The power of government institutions that manage spatial data will be reduced if the data can be accessed easily by other agencies or the public;
- Spatial data managed by government institutions contain some private data which cannot be filtered at present;
- There is suspicion that some people might misuse official published spatial data;
- Protection of copyright and confidentiality of the data have not been adequate;
- Law suits by private individuals arise due to the incompleteness of spatial data created or managed;
- There are fears of sanctions caused by inaccuracy of spatial data created or managed.

These situations require a solution through the right strategy, one of which might be the support of the regulations. Given that all government services producing spatial data have legal basis, how policy and regulation aspects are matched is an urgent issue which is discussed next.

Policy

The details of questionnaire of the assessment of policy readiness in Surabaya Municipality can be seen in the following table:

Table 8.11 Policy Support to Manage Spatial Data and Information in Surabaya Municipality

No	Policy readiness aspect	Availability	Notes
1	A strategic plan or roadmap for development of spatial data infrastructure	Available	
2	Spatial data management that follows Indonesian national standards or technical specifications determined by a Ministry / agency	Available	
3	Formal mechanisms for spatial data sharing between government institutions	Not available	
4	A regulatory mechanism for authorizing spatial data use by the public	Not available	
5	A regulation related to spatial data use and management	Not available	
6	A Mayor regulation concerning utilisation and management of spatial data	Not available	

Similar with the Province of East Java case, financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization. The financial support for SDI operationalization in government agencies consists of data, software and hardware procurement, maintenance and internet subscription. Details of the financial assistance of SDI operationalization in the Surabaya Municipality can be seen in Table 8.12.

Table 8.12 State Budget Support to Manage Spatial Data and Information in Surabaya Municipality

No	Activity	Budgeting system			
		Routine		incidental	
		APBD	APBN	APBD	APBN
1	Spatial data procurement	✓			
2	Computer system procurement	✓			
3	Maintenance / updating spatial data	✓			
4	Metadata procurement (information about spatial data)	✓			
5	Computer system maintenance / development	✓			
6	The internet subscriptions for spatial data sharing activities	✓			

The questionnaire conducted about policy aspects of building SDI in the municipality government shows that Surabaya is not ready yet. Even though there is a strategy for the development of SDI that follows Indonesian national standards, it still has constraints in the absence of policy supporting spatial data sharing. There are:

- lack of a formal mechanism for the public to access spatial data sharing;
- lack of a regulatory mechanism for authorising spatial data use by the public;

- lack of regulation related to spatial data use and management;
- absence of Mayoral regulations related to spatial data utility and management.

Although policy aspects are not ready yet, the financial support for the Surabaya SDI is good; interview responses indicated that all of the items related to spatial management have regular budget allocations from the central budget.

According to field observations, the municipality has not issued regulations nor made decisions about local spatial data network hubs. Analysis of documents related to the policy and regulation of spatial data development and sharing shows that there is only a Memorandum of Understanding (MoU) agreement on cooperation between BAKORSURTANAL (the old BIG terminology) and the Surabaya Municipality about interoperability programmes for SDI development [with a number of letters ID.01.02 / 52-De.BIDS / II / 2007 in 2007].

Overall, the municipal regulation has not explicitly governed the relationship between government services concerned with spatial data exchange and sharing. Keeping that in mind, this needs to be immediate preparation of regulations guiding spatial data sharing towards the creation of spatially enabled government in support of the Indonesian NSDI.

8.3.4 VGI performance in Surabaya Municipality

Analysis of the fieldwork reveals that VGI activities in Surabaya were conducted on project bases. Information gathered in the period of 2011-2012 about spatial development activities by VGI communities through the OSM platform in Surabaya included the "Community Mapping for Disaster Risk Exposure in Indonesia" project (UGM and HOT, 2012).

The Surabaya spatial database was collected through two schemes: the competition and non-competition OSM schemes. Spatial data was built under the OSM Mapping Competition, held in several areas in Indonesia between

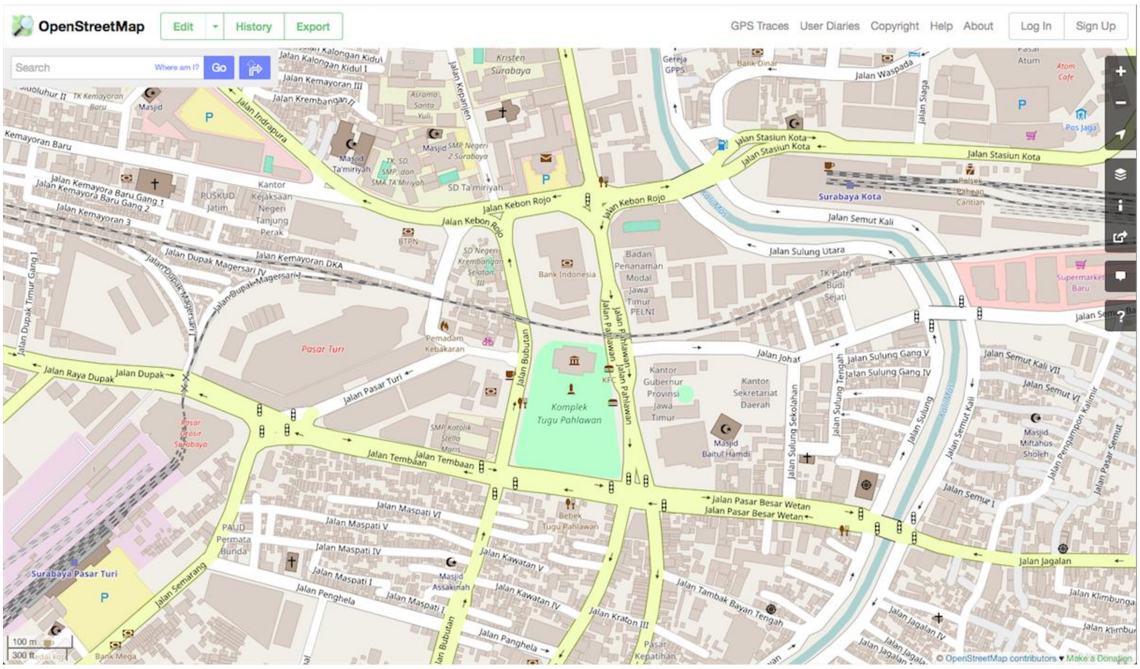
July-August 2011, while the non-competition OSM is purely voluntarily, involving community participation in building a spatial database on the OSM platform.

The VGI spatial features database was constructed in 2012 from the competition data with two thematic layers - buildings and roads , it showed the number of digitized buildings and roads were 3866 and 1328 respectively. Meanwhile, the spatial database development activities of the non-competition scheme digitized 1283 buildings and 2416 roads.

Surabaya is the second largest city in Indonesia, and one of the most densely populated urban areas in Indonesia. Completing spatial infrastructure data in this city is important for strategic planning, especially in the case of disaster. In order to reduce the number of victims, since October 2016 the InAWARE-Disaster management tool project has collectively updated Surabaya's base map, which is pivotal for an exact emergency plan of action.

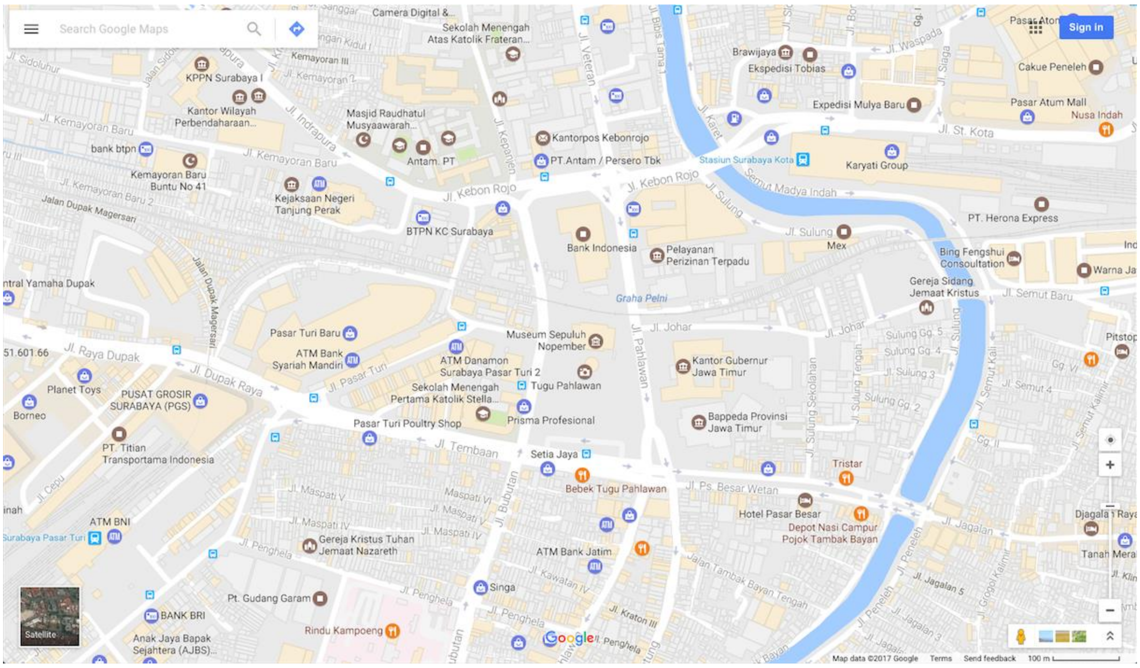
At the beginning of the project, HOT and their VGI communities concentrated on digitizing buildings, road networks and drainage systems in seven districts. As a result, over 350,652 spatial data edits and 59,133 buildings were mapped on the OSM portal. Enthusiastic VGI community participation in mapping and updating Surabaya's spatial data has managed to digitize 1.530% of spatial objects: the number of buildings mapped was 2866 in 2012 increasing to 59.133 building in 2016. This demonstrates the success of HOT in encouraging community, especially those living in the vicinity of the listed projects. The number of mapped objects will increase and the entire city of Surabaya will be cover in line with the implementation of the project until February 2017. As a comparison of completeness of Surabaya's spatial database by OSM community, spatial object features mapped by Google Maps are shown in Figure 8.9).

1) Openstreetmap



Source: OpenStreetMap, 2016

2) Google Maps



Source: Google Maps, 2016

Figure 8.9 Comparison Object Mapping Between Openstreetmap and Google Maps in Surabaya Municipality

Comparing spatial database created by VGI community in OSM with commercial spatial data and information provider by Google Maps shows that spatial data produced by both providers has similar digitized numbers of building, road network, river network datasets. This situation can be said that public engagement about creating the spatial database in Surabaya Municipality makes significant contributions regarding inform the existing Surabaya urban condition.

8.4 Spatial planning and spatial data management in Bojonegoro Regency

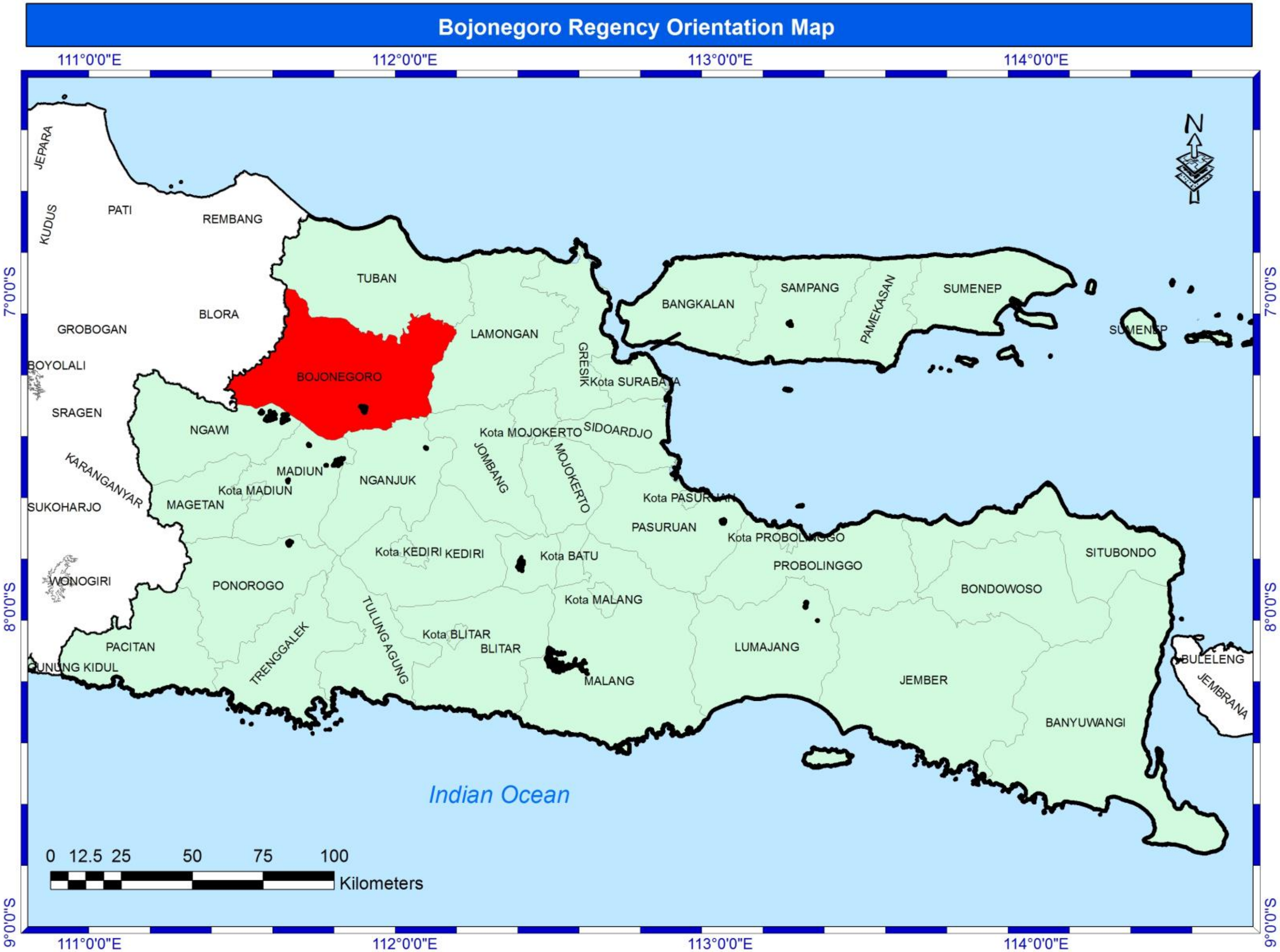
This section discusses spatial planning and spatial data management in Bojonegoro Regency. Specifically, examination of spatial data development in this region will explore SDI readiness aspects under the regency government management and VGI development in Bojonegoro.

8.4.1 An overview of spatial planning in Bojonegoro Regency

Bojonegoro is one of the regencies in the Province of East Java located 110 km from Surabaya and adjacent to Central Java Province. Bojonegoro Regency administratitive boundaries are:

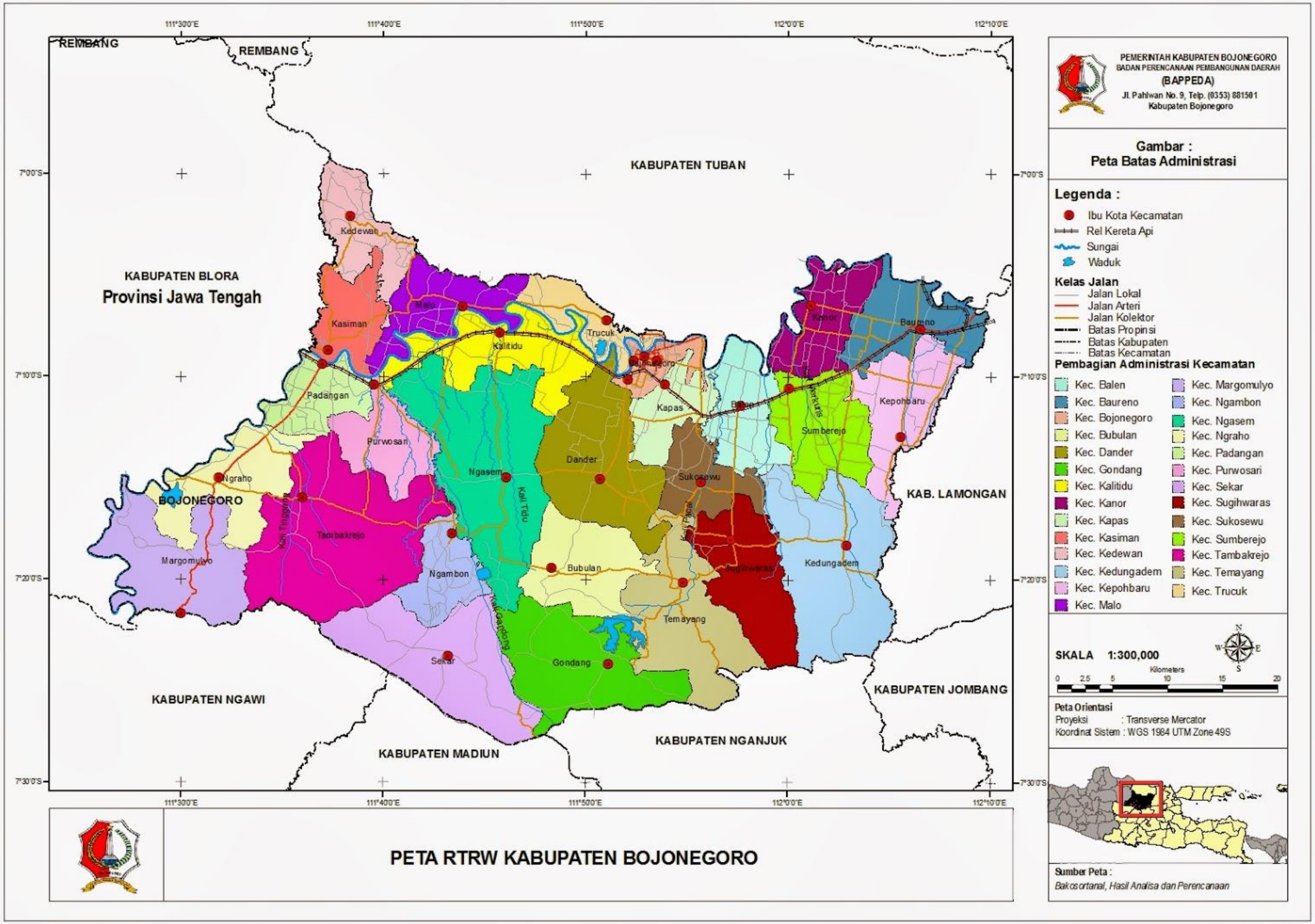
- North: Tuban regency
- East: Lamongan regency
- South: Ngawi, Madiun, and Nganjuk regency
- West: The Province of Central Java)

The location of Bojonegoro and the district (*kecamatan*) administrative boundaries in the Bojonegoro Regency can be seen in Figure 8.10 and 8.11 respectively.



Source: BIG 2016, processed by the researcher

Figure 8.10 Location of Bojonegoro Regency in The Province of East Java



Source: The Bojonegro Spatial Plan 2011 -2031 with permission to re-print from Government of Bojonegoro Regency

Figure 8.11 The Map of the Administrative Districts of Bojonegoro Regency

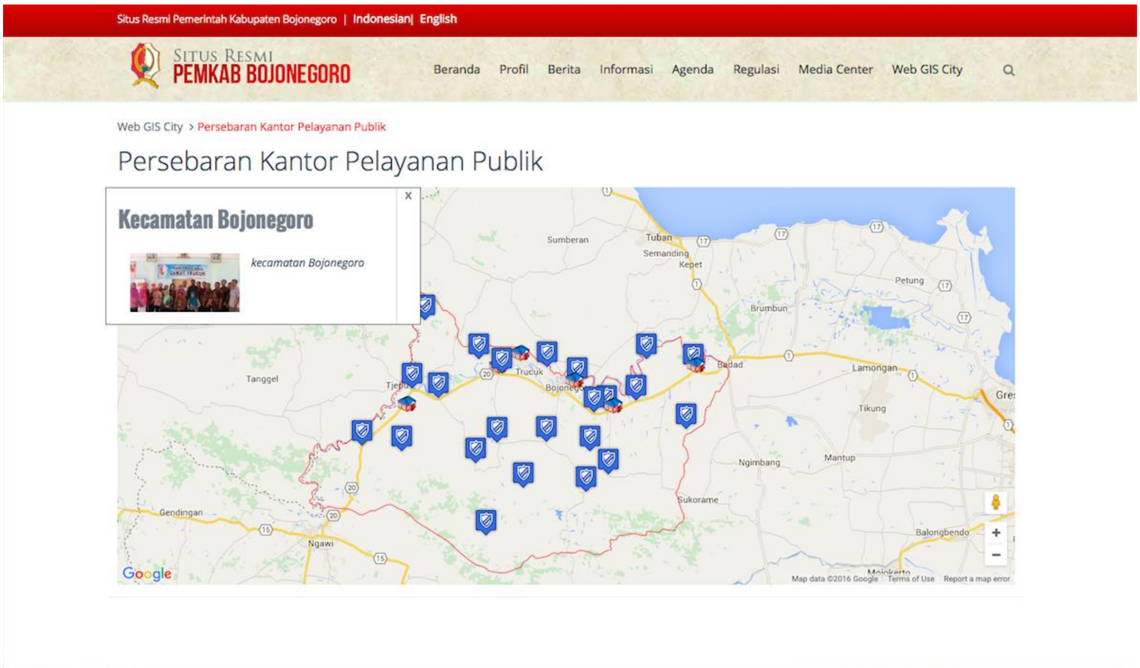
The total area of Bojonegoro Regency is 230,706 ha: 40.15% of the total area has national forest status, located in the southern part of the Regency. Paddy fields make up 32.58% of the area, primarily located along the Bengawan Solo River basin in the northern part of the Regency. Furthermore, 22.42% of the area is dryland farming and 4.85% is plantations and other uses mostly located in the middle of the Regency.

The topography of Bojonegoro Regency is dominated by hilly land in the south (southern limestone mountains) and the north (northern limestone mountains) which enclose lowlands along the Bengawan Solo River which is a fertile agricultural areas. Based on the information from fieldwork, the Bojonegoro Regency Spatial Plan (RTRW Bojonegoro) has already been ratified by Bojonegoro Regency Government Regulation No. 26 in 2011 for the planning period of 2011 – 2031.

8.4.2 Spatial data usage in the government of Bojonegoro Regency

The government of Bojonegoro started to use spatial data for spatial analysis in supporting the planning and development agenda in 2011. The initiation of spatial data usage in Bojonegoro Regency coincides with the implementation of national projects with a multi-year duration, called the Indonesian Green and Resilient Cities Project Planning System (InaGRES). InaGRES activities were previously carried out in order to support the implementation of the Master Plan for the Acceleration and Expansion of Indonesian Economic Development (*Masterplan Percepatan dan Perluasan Pembangunan Ekonomi Indonesia*, MP3EI) in order to formulate national economic strategic site plans based spatial data and information.

Spatial database development in Bojonegoro was conducted by the two parties, the government of Bojonegoro Regency and professional consultants. Database development was initiated by the Regency for the purpose of issuing development permits. At the time of the survey for building Bojonegoro spatial database, the recording of geographic coordinates by the regency government had used GPS to be subsequently transferred into GIS applications, whereas, the spatial development database integrated with the internet had been developed by professional consultants. Spatial database development undertaken by the Regency has continued with WebGIS which provides spatial information about public services (See Figure 8.12)



source: http://www.bojonegorokab.go.id/webgis/index/3/Persebaran-Kantor-Pelayanan-Publik

Figure 8.12 The Bojonegoro Regency WebGIS

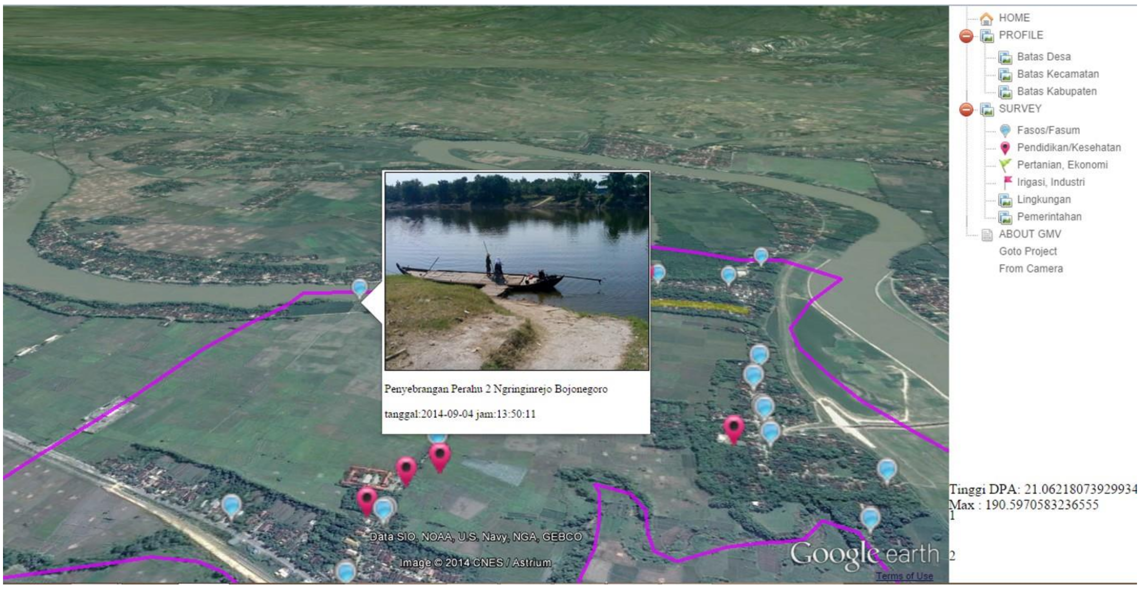
Bojonegoro Regency WebGIS has published some significant spatial public services information, such as urban facilities and infrastructure distributions. But, citizens who require spatial data on the WebGIS can only see it on the platform without being able to download it. In the future this technology needs to be to create spatial data interoperability with publics and other regions outside the Regency and national levels for realising success of Indonesian NSDI.

The Regency also introduced e-participation for community involvement in the planning and development process. In the press conference held by INFID (The International NGO Forum on Indonesian Development) and Open Government Indonesia in April 2016 to create an open government partnership with the full involvement of society, *Bupati* (Head of Regency) Bojonegoro stated:

> *"In establishing an open government partnership, the Bojonegoro government created several innovations. Firstly, the revolution of [bringing] data to the village level; the data can be utilised by a participatory stakeholder / NGO to collaborate in the democratic atmosphere. Secondly, mentoring NGOs in community development activities. Thirdly, creating a democratic atmosphere at village level through "game my village" e-participation platform by involving the public and stakeholders directly in the planning and development process adjusted to local government budgets and associated with sustainable development goals…"*

Source: Detiknews access in http://news.detik.com/berita/3188919/ini-usaha-kang-yoto-sejajarkan-bojonegoro-dengan-paris at 16.57 on 25t[h] July 2016

Public participation in Bojonegoro Regency uses digital spatial data and information through the "Game My Village" e-participation platform shows that the government of Bojonegoro Regency gives priority to their community to engage in the planning and development process. "Game My Village" is the e-participation application pertaining to rural planning and development processes by displaying the development of social data visualization on the village spatial information (See Figure 8.13).



Source: http://sinergantara.or.id/tag/game-my-village/

Figure 8.13 "Game my village" as A Public Participation Platform in Bojonegoro Using Spatial Data

The principle of Game My Village e-participation is creating public engagement in decision-making related to the government's planning and development programmes in Bojonegoro Regceny. The working principle of Game My Village can be explained as follows:

- 'Gamification' of the decision-making process

The method makes decision-making in meetings become an interesting process like playing a game.

- Data visualization of the situation in the village

The physical objects and statistical data which are available in the village would be digitalised and visualised in a display that can be seen by all rural participant discussion forums.

- Participatory decision making

The level of participation in decision-making processes at rural meetings can be improved through the interaction of the participants with the spatial objects visualization. This system facilitates the participants of the forum to submit ideas, suggestions, or refusal of the government's ideas. Responses should not be only verbal (speaking), but can also take advantage of the visual process.

The overall discussion of public participation indicates that the Regency government facilitates public engagement through developing the "Game my village" e-participation platform, which takes advantage of the geo-spatial data identification and preparation for planning and development programmes. The regency has implemented spatially-enabled government in the dialogue between the government and the public. To explore the readiness of Bojonegoro Regency government in establishing SDI, the next section discusses the five elements of SDI assessment.

8.4.3 SDI under Bojonegoro regency government management

According to information from the research fieldwork, Bojonegoro Regency was not included in the I-SRI study assessment by BIG and PPIDS UGM in 2013 and 2014. However, BIG portal news dated April 2014 http://www.bakosurtanal.go.id/berita-surta/show/15-simpul-jaringan-informasi-geospasial-dapatkan-penghargaan-dari-big revealed that Bojonegoro Regency had already been assessed in terms of establishing local spatial data network hub by an independent study by BIG in 2013. According to an internal Report (BIG, 2013), Bojonegoro Regency was chosen as the most favourite regency category in Indonesia pertaining SDI preparation. The next part discusses the preparatory for SDI in Bojonegoro Regency studied by BIG in 2013 and the interview conducted by the researcher in 2015.

Data

The details of the standard and data aspects of the preparatory assessment in Bojonegoro Regency can be seen in the following table:

Table 8.13 Spatial Data Availability in Bojonegoro Regency

No	Item Inspected	Minimum Standards	Information
1	Basic Geospatial Information	Topographic (*Rupabumi*) map scale of 1: 25,000 for all the whole Bojonegoro for regency pertains spatial planning purposes	Available
		Topographic (*Rupabumi*) map, scale 1: 5,000 for detailed spatial planning formulation	Not available
2	Thematic Geospatial Information	Landuse planning and structural planning maps in accordance with the Regional	Available

		Regulation for Bojonegoro spatial plan guides.	
		Thematic maps to support Bojonegoro spatial planning formulation	Available
		The zoning block land use maps in accordance with Regional Regulation as detailed Bojonegoro spatial plan guides.	Not available
		Thematic maps to support detailed Bojonegoro spatial plan formulation.	Not available
		Bojonegoro building and neighborhood plan maps	Not available
		Thematic maps to support Bojonegoro building and neighborhood plan formulation	Not available

According to the BIG survey questionnaire (BIG, 2013) the readiness of basic spatial data and information for the spatial planning process in the Regency government is adequate. It has a topographic map at 1: 25,000 scale, a land use planning map and a spatial structure plan map. Added to this, some thematic maps, such as administrative boundaries, transport / road networks and urban infrastructures are also available.

However, the availability of spatial data and information at the detailed scale was not ready yet at the time of the BIG survey. The following items were not available: topographic map on a scale of 1: 5,000; the zoning block land use maps in accordance with local government regulation for the detailed Bojonegoro spatial plan (*Rencana Detail Tata Ruang*, RDTR) guides, thematic maps to support detailed Bojonegoro spatial plan formulation; Bojonegoro building and neighborhood maps (*Rencana Tata Bangunan dan Lingkungan*, RTBL); and thematic maps to support Bojonegoro building layout and neighborhood map formulation.

Observations in February 2015 revealed that spatial data for Bojonegoro already existed and manage by the Bojonegoro Regency Planning Board (BAPPEDA Bojonegoro) and could be accessed by the public on the following portal: http://www.bojonegorokab.go.id/webpolygon/index/11/Boundary-districts. The thematic spatial data features that have been published are as follows:

- The district boundaries under Bojonegoro Regency authority features;
- Distribution of primary schools;
- Distribution of public service offices;
- Distribution of hotels;
- Distribution of health facilities;
- Distribution of restaurants;
- Distribution WiFi facilities;
- Distribution of educational facilities;
- Oil and gas business areas;
- The distribution centres for small enterprises;
- The distribution of tourist attractions;
- The distribution of potential natural disaster risk spots.

In future, spatial data open to the public will expand to other themes.

> *"In the future, spatial data themes to be published will be increased So, the spatial data that are open especially concerning spatial planning can be instantly shared. Spatial data sharing is fully supported by bupati to share all the data for public consumption. The format of spatial data sent to the BIG server is already in the shp format. However, this also depends on the consent of the top leadership of the Partnership Agreement."*

(BAPPEDA Bojonegoro Senior Management Staff; Interview at 18th February 2015)

In general, availability of spatial data and information under Bojonegoro Regency management are adequate, but the released data cannot be shared yet, it can only be downloaded in JPEG format. Published spatial data is not yet fully integrated with the national spatial data network hub. Thus, In the future, adjustments to local spatial data will be needed to make it interoperable with national and other region's spatial data.

Human resources

Details of the human resources aspect of assessment of preparation for SDI in Bojonegoro Regency can be seen in the following table:

Table 8.14 Human Resource Capability to Manage Spatial Data and Information in Bojonegoro Regency

No	Item inspected	Minimum Standards	Information
1	Geo-science expertise	Geodetics and geomatics/geography	Not available
		GIS	Not available
2	Information technology expertise	Computer engineering	Available
		Information management	Available

Answers to the BIG survey questionnaire (BIG, 2013) reveal that the human resources of the Regency government for handling and managing spatial data and information for the spatial planning process are not adequate yet. There are no personnel with educational backgrounds in geo-science. Staff concentrate on administrative matters rather than technical issues, such as building a spatial database. The survey for this research confirmed that the Regency government has no personnel with knowledge or skills in GIS, and the development of spatial database management is handled by professional consultants which mostly located in big cities, because of most GIS technologies and professionals concentrated in big cities, such as in this case is Surabaya.

> *"Up to now, the functional careers [Jabatan Fungsional] provision in Bojonegoro regency only the auditor inspectorate, there is no GIS officers yet. Actually, the staff meeting proposed the functional careers for GIS officer, however, until now [this is] constrained by policy and regulation, so that [this idea] cannot be realized. Lack of human resources still occurs here, therefore, one solution is hire GIS professional who mostly concentrate in Surabaya. However, with regular GIS training in the future, it is expected that human resource for handling spatial data management can be solved."*
>
> (BAPPEDA Bojonegoro Senior Management Staff; Interview at 18th February 2015)

Technology

The details of the technological element of assessment of preparation for SDI in Bojonegoro Regency can be seen in the following table:

Table 8.15 Technology Capacity to Manage Spatial Data and Information in Bojonegoro Regency

No	Item inspected	Minimum Standards	Information
1	Software		
1a.	Geospatial data analysis	Option 1: Quantum GIS (Open Source)	Not available
		Option 2: ArcGIS/ArcInfo (Commercial)	Not available
1b.	Spatial database development	Option 1: PostGIS/PostGreSQL (Open Source)	Not available
		Option 2: ArcSDE/Microsoft SQLServer (Commercial)	Not available
1c.	Geo-spatial information dissemination	Option 1: Palapa/OpenGeo (open source)	Not available
		Option 2: ArcGIS Server (Commercial)	Not available
2	Hardware	PC	Available
		Server	Available
3	Network		
3a.	Intranet network	Fiber optic network 1GB	Available
3b.	Internet	Bandwidth international 5 MB	Available

Answers to the BIG survey questionnaire (BIG, 2013) reveal that the Regency government is not yet ready to use SDI technology especially, that not all spatial data processing devices are available. According to the observations made during research fieldwork, BAPPEDA Bojonegoro are still negotiating with BIG regarding technology support for spatial data sharing.

"In the meantime, we have recently started cooperating with BIG, including the procurement of servers to support spatial data sharing operationalisation. In the future, the main server will be deposited in the Regency Communication and Information Agency (Diskominfo), which has a fiber optic network and the main server is connected to the INA-SDI Geo-portal Server. The secondary server is placed in BAPPEDA Bojonegoro, which functions to send spatial data to the main server in BIG."

(BAPPEDA Bojonegoro Senior Management Staff; Interview at 18th February 2015)

Organisation

The details of the institutional aspects of the assessment of Bojonegoro Regency can be seen in the following table:

Table 8.16 Organisation Capacity to Manage Spatial Data and Information in Bojonegoro Regency

No	Item inspected	Minimum Standard	Information
1	Spatial Data Network Hub	Technical units Echelon III / IV which have the function of the coordinates of Geospatial information services at the Regency level	Not available
2	Cooperation	Cooperation between spatial data and information sharing; and the Regency Spatial Planning Cordinating Board (*Badan Koordinasi Penataan Ruang Daerah Kabupaten*, BKPRD Kabupaten)	Not available
		Cooperation of the Regional Research and Development Agency	Not available
		Cooperation with the National Spatial Data Networks Hub	Not available

Based on the BIG survey (BIG, 2013), the institutional elements for Bojonegoro SDI are not ready yet; the spatial data network hub and cooperation with other government agencies are not available. However, the research surveys conducted in February 2015 found that institutions for the management of spatial data have been established with the enactment of the Bojonegoro Regent Regulation no. 12 of 2015 for the Bojonegoro geo-spatial information network hub.

In this Regulation, BAPPEDA Bojonegro was appointed as coordinator of the Bojonegoro spatial data network hub. All government services under Bojonegoro Regency authority and Bojonegoro business enterprises agency become Bojonegoro spatial data network hub members. Two other institutions are involved in spatial data management, namely the Bojonegoro Regional Employment Board (*Badan Kepegawaian Daerah*, BKD) which is in charge of building human resources capacity in relation to spatial data and information management; and the Bojonegoro Communications and Information Office, which has a role in developing networks for spatial data sharing and exchanges. As BAPPEDA Bojonegoro Senior Management Staff said:

> *"According to the plan, all SKPD [Bojonegoro's sector units] will be involved to manage spatial data and BAPPEDA Bojonegoro will be appointed as the coordinator. If the Regent Regulation (Peraturan Bupati) of spatial data network hubs has enacted [in April 2015], then, the action will be followed by issuing the official technical team appointment letter. SKPD included in the official technical team will conduct GIS training. In the future, individuals who attended the training will be appointed to handle spatial data in each the Regency Official Agency."*

(BAPPEDA Bojonegoro Senior Management Staff; Interview at 18th February 2015)

In general, the institutional aspect of Bojonegoro Regency management is adequate for SDI implementation. However, the observations indicate there is little commitment to, and inconsistency between government sector services in performing spatial data development and sharing. Performance pertaining to spatial data development and sharing lacks details for basic tasks and functions at each government institution for creating and sharing spatial data. This situation requires a solution through the preparation of standardised operating procedures (SOP) for each government sector service under the government of Bojonegoro Regency in order to implement SDI development.

Policy

The details of the assessment of policy aspects of preparation for SDI Bojonegoro Regency can be seen in the following table:

Table 8.17 Policy Support to Manage Spatial Data and Information in Bojonegoro Regency

No	Item inspected	Minimum Standard	Information
1	The appointment of a clearing unit	The Decree of the Regent to the Technical Unit Echelon III / IV to maintain geo-spatial data and information at each sectoral government services	Available
2	Geo-spatial information administrative procedure	The existence of Regent Regulations for the implementation of geo-spatial information at Regency level	Not available

Based on information from fieldwork observations, the Regency government has issued the Regulation relatimh to clearing unit designation set out in Bojonegoro Regent Regulation No. 12 of 2015 for a local spatial data network hub, which appointed BAPPEDA Bojonegoro Regency as coordinator of the Bojonegoro Regency spatial data network hub.

On the other hand, geo-spatial information administrative procedures in Bojonegoro are not yet available yet, and spatial data development and sharing amongst government agencies has not been expressly provided for the policy and technical elements. Therefore, the situation needs immediate preparation of regulations and Standard Operational Procedure (SOP) for each government sector services under the government of Bojonegoro SDI in order to spatially enable government and support the implementation of the Indonesian NSDI.

Even though from policy aspects are not ready yet, financial support by Bojonegoro Regency for spatial data development is been well-prepared. It is interview for this research indicates that Bojonegoro Regency has been allocated a regular local government budget for spatial data and information since 2013.

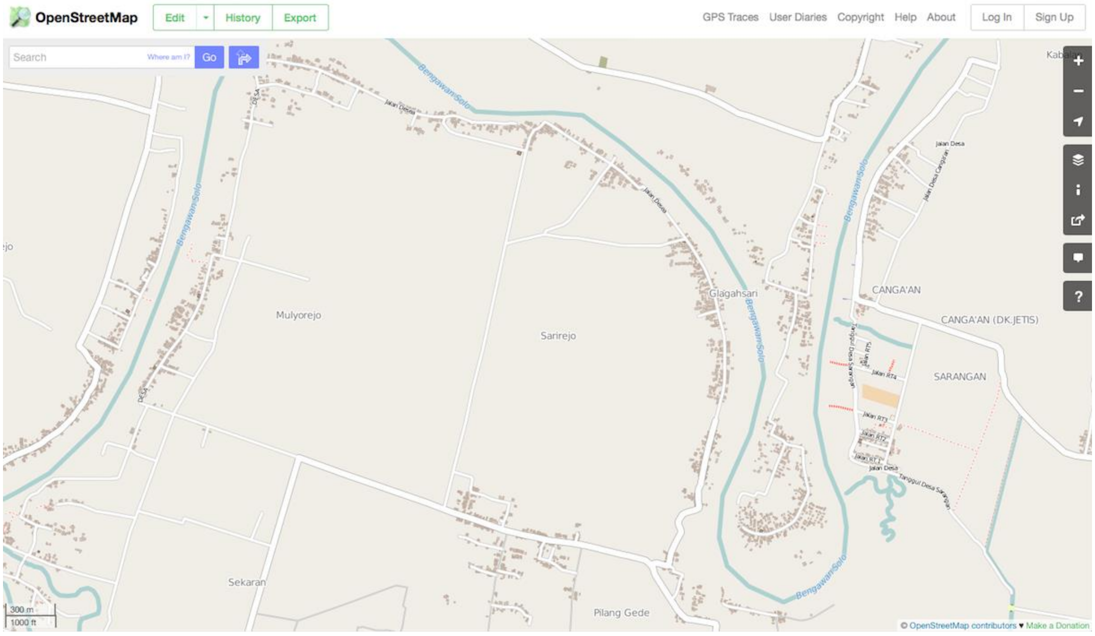
> *“Spatial data management operationalisation is going to use the annual local government budget, the budgeting attached to BAPPEDA Bojonegoro with the name of the programme is "Geospatial data and information development in Bojonegoro Regency." It has been budgeted for since 2013; and in the future will continue to be included in the local government agenda every year.”*

(BAPPEDA Bojonegoro Senior Management Staff; Interview at 18th February 2015)

8.4.4 VGI performance in Bojonegoro Regency

Fieldwork investigation and content analysis of internal reports related VGI community activities in Bojonegoro reveal that the spatial database was created in connection with the contingency plan programme in the disaster management agenda. The programme was organised by the Province government of East Java through the Bojonegoro Regional Disaster Management Agency (*Badan Penanggulangan Bencana Daerah*, BPBD Bojonegoro) collaborate with HOT Indonesia in 2013-2014 (HOT, 2014).

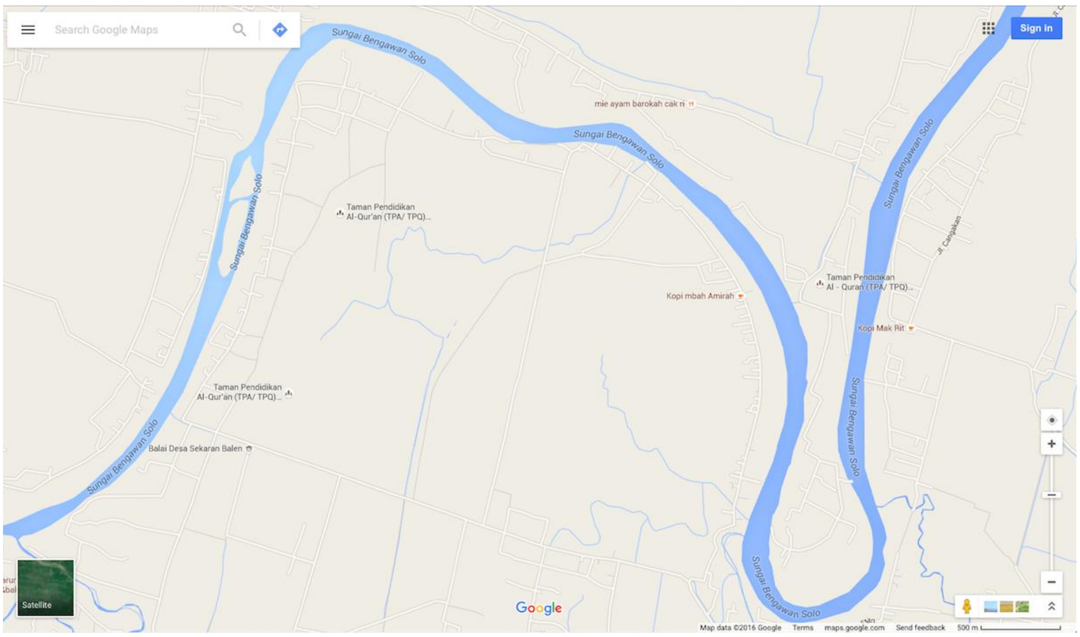
The contingency plan activities in Bojonegoro Regency were undertaken in the flood affected regions due to the flooding of the Bengawan Solo River. Thus, the development of the spatial database in Bojonegoro carried out along the Bengawan Solo river banks (HOT, 2014) (See Figure 8.14).



Source: OSM, 2016

Figure 8.14 Part of Bojonegoro Regency Spatial Data Development by OSM Community

Spatial database development by VGI communities on the OSM Platform in Bojonegoro is more accurate in presenting critical infrastructure along the Bengawan Solo River compared to spatial databases development by Google maps (See Figure 8.15).



Source: Google Map, 2016

Figure 8.15 Part of Bojonegoro Regency Spatial Data Development by Google Maps

Comparing Figure 8.26 and 8.27, the situation can be said that civil engagement pertaining to building the spatial database in Bojonegoro Regency makes significantly contributions in supporting Bojonegoro planning and development activities.

In general, spatial database development by VGI communities in Bojonegoro is very effective in presenting vital facilities and infrastructure distribution to support Bojonegoro planning and development purposes. However, these VGI activities were carried out on the basis of the government's projects, which has lead to a lack of continuity in the production and development of the spatial database for Bojonegoro.

8.5 Exisisting Spatial data dissemination flows between the Province of East Java, Surabaya Municipality and Bojonegoro Regency

The study of spatial data sharing for supporting spatial planning processes in three case studies in more developed regions at different government levels reveals that spatial data sharing is barely developed the municipality and regency levels. This can be seen from spatial data dissemination flow in Figure 8.16.

= Strong spatial data sharing

= Less or never exist spatial data sharing

= Highly potential integration

= Less potential integration

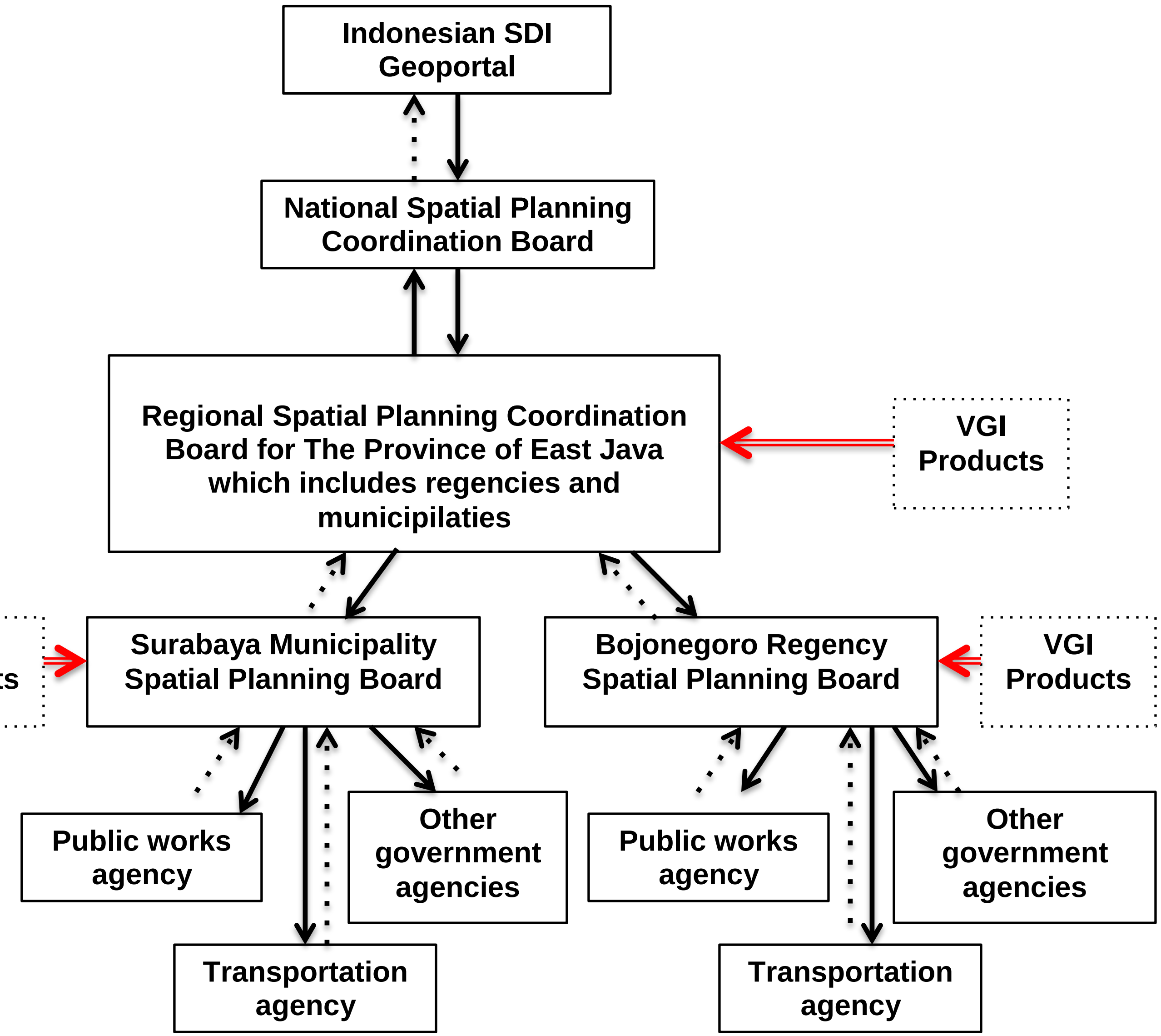


Figure 8.16 The Existing Spatial Data Flows Under Selected the Province of East Java Authority Areas

Figure 8.16 shows that there are top-down workflows in existing spatial data dissemination in areas of more developed regions and this has meant that SDI has not developed well. Lack of SDI implementation in the more developed regions can be explained as follows: primarily, the work process of spatial data acquisition, display and distribution in these case studies is often defined in a vertical structure but are carried out on ad hoc or project bases in horizontal organisations. Lowest organisational level do not share their data with upper levels due to lack of technical procedures and lack of leadership in implementing SDI. Spatial data and information sharing at province and local government levels are conducted with a top-down approach as well as trans-vertical and trans-horizontal data and information exchange.

Satisfactory performance regarding human resources, technology and financial aspects of establishing a SDI will be meaningless in the absence of organisational support, specifically leadership characteristics, and policy aspects with derivative legal instruments, such as regulations and standardised operational procedure related spatial data development and sharing. Lack of organisational support and policy leads to less political communication amongst other institutions to share their data and information and as a result, the implementation of SDI cannot be established. If the lack of local SDI performance affects to the national level, then the situation indicates the weak NSDI performance.

The failure of SDI at the local level can be explained by the theory of organisational maturity level regarding organizational change and information dissemination (Kok and Loenen, 2005) (See Chapter 2, section 2.4.3). According to this model, in relation to spatial data dissemination activities, Surabaya Municipality and Bojonegoro Regency are positioned at Stage I. At this level, organisational behaviour can be described as conservative, self-seeking and less willing to transform into a different system. On the other hand, the Province of East Java can be seen to be positioned at Stage IV. In this class, the organisation has a positive response and full support to contribute to the change process. In terms of the NSDI context, the stakeholders participating as NSDI custodians have worked with sharing and exchanging data for the public domain.

The successful implementation of spatial data development and sharing amongst government institutions (for this case study of the Province of East Java) can be explained by the argument of Obermeyer and Pinto (2008) (See Chapter 3, section 3.4) . They argue that spatial data/information sharing can occur with a least-cost resolution condition between two actors - the owner of data/information and the seeker of data/information. They examine bargaining, coercion and appeals to professionalism related to spatial data/information sharing.

Within the fundamental idea of bargaining, organisations have an assortment of assets which are available to them. On a few occasions, data/information swaps might be conceivable. Some organisations might have the financial assets to buy data/information from different organisations or to give some other monetary consideration. Coercion is available to those organisations with the force or power to exercise it. On the other hand, appeals to professionalism are accessible to everybody. Where the equalisation of force supports the seeker of data, the organisation might apply its power and request the data from the weaker owner of the data.

In this sense, the production of VGI data in the regions of Indonseia can be seen to have limited potential for integration with official spatial data because spatial data created by VGI communites have no power to be involved under the official spatial data management. In addition, official leader organisations still doubt the quality, accuracy and validation of spatial data created by the VGI community.

8.6 Summary of Chapter

The designation of the new spatial planning was enacted by Law No.26 of 2007 as the amendment of the old spatial planning Law. No 24 of 1992. As a result, all provinces in Indonesia are required to revise their existing spatial plans within two years from the enactment of the law, and for municipality and regency levels required three years.

This research has found that some Indonesia regions have not ratified their spatial plan yet because political compromises needing to reached in discussion about spatial plans, including changes to technicalities and content of spatial plan maps. In addition, the bureaucratic supervision of the production of planning maps conducted face-to-face contact in the BIG headquarters office increases the length of the time for spatial planning enactment.

Overall, this chapter attempted to answer a part of the fourth research question: "How is spatial data management performing at provincial and local government levels in supporting Indonesian NSDI?" SDI theories suggest that SDI readiness assessment in areas with more developed regions will present good SDI performance. However, the empirical case study findings reveal that this may not always be the case.

Based on the five elements of assessment for SDI readiness, spatial development performance in more developed regions can be summarised as follows:

- Data

Generally, the three case studies in developed governance capability areas discovered that much digital spatial data is readily available. However, spatial data published for public use only allows display or data and spatial information can be downloaded in uneditable format, in this case is in raster format, such as JPEG format.

- Human resources

Investigations and observations of spatial data management show different results for the three administrative levels. Human resources at province and municipality levels have good capacities for managing spatial data and information, which is lacking at regency level. Regency level staff have fewer relevant universities qualifications and regency offices have less equipment and facilities than the other levels.

The examination of the civil servce bureaucratic system reveals that most of the Indonesian government institutions are only implementing for structural careers (*jabatan struktural*) of working units with no functional careers (*jabatan fungsional*) training for spatial data and information management. This creates a problem because promotion or changes in job specifications are not accompanied by the replacement of personnel with geo-spatial knowledge. Furthermore, lack of specific positions with responsibility for spatial data and information management leads to the personnel in charge of managing spatial data and information multitasking jobs that are not related to the geo-spatial field, such as performing day-to-day administrative work.

- Technology

Technology performance in the three case studies reveals different assessments of government levels. The Province and the Municipality have strong capacity for technological provision of SDI. But the Regency level is less technologically development than the Province or Municipality. The situation can be explained due to the regency level in geographically far away and so can't get technology devices yet to support spatial data sharing.

- Organisation

SDI readiness assessment and the fieldwork reveal that most of the government institutions have initiated moves towards SDI. However, the initiative of leaders of particular government institutions is not followed up by other leaders. Sometimes, competition between working units under particular government management occurs. Furthermore, most of the bureaucractic system of Indonesian government uses centralised management approaches and is oriented to vertical hierarchical organisational structures. These situations mean there is a lack of creativity and innovation in the working atmosphere of government due to the need to wait for approval for programme implementation from the highest level.

- Policy

General observations from the case studies reveal that even though legal arrangements regarding spatial data and information sharing exist at the Executive level, there are no details for spatial data and information sharing procedures or Standard Operational Procedures (SOP) that cover the lowest working units up to highest executive positions and *vice versa* in government institutions. However, financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization.

Five aspects of SDI appraisals reveal that province and municipality level shows good performances, but those performances are not followed by the regency level. In general, more developed regions are well organised to implement spatial data and information sharing for spatial planning practice. According to information from the fieldwork, additional elements that influence spatial data and information sharing include socio-political stability, funding support from the local government itself and central government and leadership characteristics regarding spatial data and information sharing agenda.

Potential SDI and VGI integration depends on social interactions between VGI communities and government agencies to build trust and social capital values. In addition, security assurance and awards for data and information sharing by citizens with government agencies are crucial factors in achieving a productive atmosphere for spatial data and information sharing.

The next Chapter examines the characteristics of spatial planning and spatial data management of the selected less developed governance regions as a comparison.

CHAPTER 9

SPATIAL DATA MANAGEMENT IN LESS DEVELOPED REGIONS

9.1 Introduction

Since the decentralisation reforms of the 1998 era, those provincial, municipality and regency governments equipped with improved capabilities, have achieved better public services. With respect to Spatial Data Infrastructure (SDI), these increasing levels of responsibility are reflected in the growing interest in Geographical Information System (GIS) as a computer-based technology in daily government activities for spatial planning purposes.

A comprehensive analysis of SDI in Indonesia of comparative studies between two or more areas with different government conditions under one political geographical authority will help to identify conditions for the success of National Spatial Data Infrastructure (NSDI). Therefore, this chapter explores SDI readiness in three areas with less developed governance regions according to *Kemitraan 2012* criteria and BIG history of GIS development (See Chapter 4).

These case studies consider situations where there is limited spatial data usage and analysis activity and thus illustrate the difficulties for province, municipality and regency with limited resources wishing to build SDI. The discussion of SDI readiness in this chapter follows a similar order to the previous chapter and is still aimed at answering the fourth research question: “How is spatial data management performing at provincial and local government levels in supporting Indonesian NSDI?”. It aims to investigate the relationship between areas with more developed and less developed regions for creating the NSDI innovation model to support spatial planning process in Indonesia which is outlined in Chapter 10.

9.2 Spatial planning and spatial data management in the Province of West Nusa Tenggara

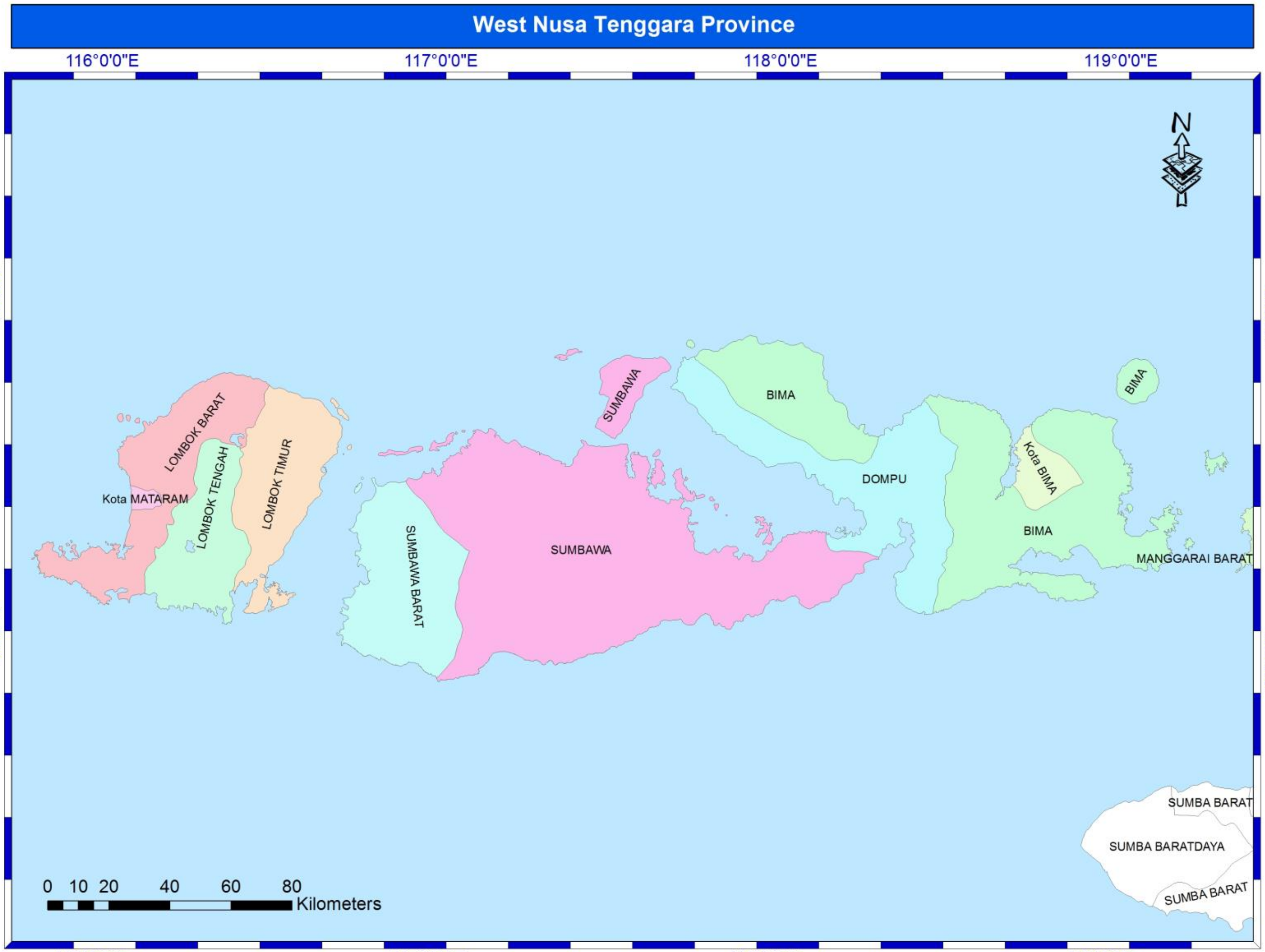
This section discusses spatial planning and spatial data management in the Province of West Nusa Tenggara. Specifically, the examination of spatial data development in this region explores SDI readiness under Province government management and VGI development in West Nusa Tenggara Province.

9.2.1 An overview of spatial planning in the Province of West Nusa Tenggara

The Province of West Nusa Tenggara consists of two large islands, Lombok and Sumbawa, which are surrounded by 280 smaller islands (See Figure 9.1). The total area of this Province is 49.312,19 km^2 with land areas of 20153.15 km^2 (40.87%) and marine areas of 29159.04 km^2 (59.13%) and a long coastline of 2,333 km.

Geographically, the Province has borders with the Lombok Strait or the Province of Bali to the West; Sape Strait and East Nusa Tenggara Province to the East; Java Sea and Flores Sea to the North; while the Indian Ocean borders its southern coast.

According to information gained during fieldwork, West Nusa Tenggara Province Spatial Plan (RTRW NTB) was ratified by the West Nusa Tenggara Provincial Government Regulation No.3 of 2010 for the planning period of 2009 - 2029. Like the case of Surabaya Municipality, the RTRW NTB has been legalised but the spatial plan maps have not yet been approved by BIG (See Chapter 5, Figure 5.9 for the provincial spatial planning procedure from proposal to enactment), and were still at the discussion stage in 2016.



Source: BIG 2016, processed by the researcher

Figure 9.1 The Province of West Nusa Tenggara

Slightly different from the case of the ratification of RTRW Surabaya, RTRW NTB has attached the official spatial plan maps, even though the content technicalities are still under consideration by BIG as part of the legal proceedings. The resolution of any discrepancies found between what is legally required and the submitted plans must follow strict legal procedures. Detailed examination of the legal procedures for resolving discrepancies is beyond the scope of / not the aim of this study.

9.2.2 Spatial data usage under the Provincial Government of West Nusa Tenggara

Spatial data usage under the provincial government of West Nusa Tenggara began in the 1990s. The initiation of spatial data usage in this Province was conducted simultaneously with the implementation of the national geo-spatial project, called the Land Resource Evaluation Planning (LREP) II Project (See Chapter 6, section 6.3.1). When LREP II project was completed, the Province of West Nusa Tenggara was selected again as part of the national coastal project, called The Marine Resource Evaluation Planning (MREP) (See Chapter 6, section 6.3.1). Both of these activities were initiated by the Directorate of Regional Development in the Ministry of the Home Affairs.

LREP studied the land areas, while MREP studied the waters, with an overlap between the projects in the coastal regions. During the implementation of projects, there were different spatial data methods, data bases and formats between the LREP and MREP projects. To resolve these, the Provincial Planning Board of West Nusa Tenggara agency (BAPPEPROV NTB) initiated building a spatial database that would be interoperable with all spatial data and information. In building the spatial database, the Provincial Data Centre of West Nusa Tenggara (*Pusat Data Provinsi Nusa Tenggara Barat*, PDP NTB) was established in the period of 1998-1999's. In an interview, one of the senior management staff of BAPPEPROV NTB said:

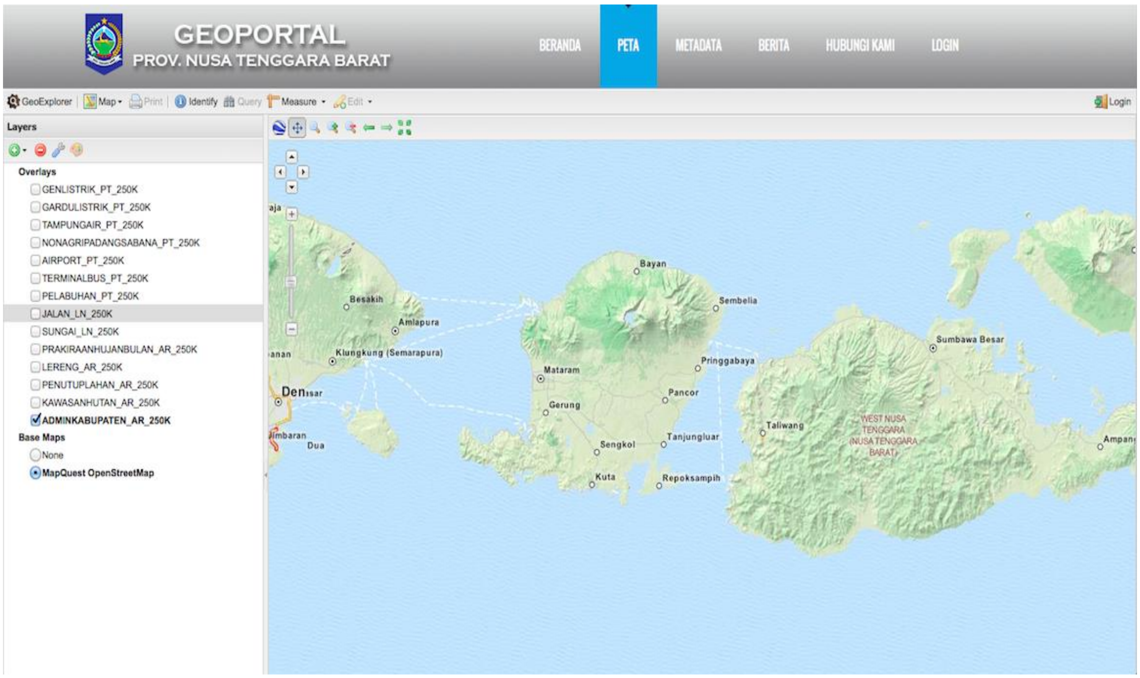
> *"During the running of both projects, based on the evaluation of existing studies of LREP and MREP, where for the LREP more studies on the mainland, while the MREP studies over the*

waters, there is a transition region in the two projects, namely the coastal areas. The coastal areas become overlay theme for these two projects. During the project, there was a difference in spatial data methods, database and formats between the LREP and the MREP projects. Then, within this consideration, the Provincial government through BAPPEPROV NTB initiated to unify spatial data and information perspectives between the two projects. Because the MREP was the new programme, we gained the approval from LREP project manager to combine coastal data and information from MREP. Later on, the Provincial Data Center of West Nusa Tenggara (PDP NTB) was established in 1998-1999."

(BAPPEPROV NTB Senior Management Staff; Interview at 9th March 2015)

In future, the establishment of a spatial database and spatial data usage will consider the provincial SDI performance. The province of West Nusa Tenggara has been ready to use and analyse spatial data for daily government workings in planning and development programmes since PDP NTB was established in this Province.

The fieldwork conducted in March 2015 revealed that the Province government has built a geoportal for saving and displaying spatial data and information related to Provincial spatial planning and development. The geoportal can be seen on the link http://dashboard.bappeda.ntbprov.go.id/palapa_v2/web/peta (See Figure 9.2).



Source: http://dashboard.bappeda.ntbprov.go.id/palapa_v2/web/peta

Figure 9.2 The Province of West Nusa Tenggara Geoportal

The geoportal not only displays provincial spatial planning and development information but also provides some thematic public service locations, such as tourism sites and public utility distributions.The inclusion of spatial data for planning and development analysis shows that the Province government is interested in developing spatial data management. The study of the readiness of the Province government for building SDI is discussed in the next section through the five SDI aspect assessment aspects (data, people, technology, organisation, and policy).

9.2.3 SDI under the government of West Nusa Tenggara management

Like the SDI assessment in the previous chapter, the study of SDI readiness in the West Nusa Tenggara Province was carried out by adopting the I-SRI method of assessing the 'available' or 'not available' answers for I-SRI's variables. In addition, a detailed analysis related to the readiness of SDI development study was conducted through interviews, observation and content analysis of policies and internal reports.

Based on the I-SRI study, the Province of West Nusa Tenggara ranks second of 27 provinces where selected in I-SRI target in Indonesia in readiness to implement provincial SDI in support the Indonesian NSDI (See Appendix D). The Provincial of West Nusa Tenggara SDI readiness assessment is interesting, because, even though the general governance assessment of the Indonesian Governance Index (IGI) performance assessment gave an unsatisfactory result, the I-SRI assessment shows the Province to be performing well. The IGI assessment ranks the Province's governance performance ranks 19 of 33 provinces in Indonesia under the “so-so” governance criteria (See Chapter 4, table 4.2).

Data

The details of the standards and data aspects of assessment of preparation for SDI in the Province of West Nusa Tenggara can be seen in the following Table:

Table 9.1 Spatial Data Availability in The Province of West Nusa Tenggara

No	Spatial data readiness aspects	Availibility	Coverage areas
1	Topographic map (*Rupabumi*)	Available	100%
2	Land parcel map	Not Available	
3	Land and property tax map	Available	<50%
4	Administrative boundary map	Available	100%
5	Spatial planning map	Available	100%
6	Detailed spatial planning map	Available	<50%
7	Road network map	Available	100%
8	Urban and regional utility map	Available	100%

All spatial data has transformed into digital geo-referenced format; and the official spatial data that has been published for the public is available through the Province of West Nusa Tenggara official website. However, spatial data published for public use on the Province of West Nusa Tenggara official website only allows display or data and spatial information can be downloaded in uneditable format (JPEG).

The I-SRI review (BIG, 2014c) shows that basic spatial data and information for the spatial planning process are already available. It is characterized by the availability of topographic maps covering 100% of the Province area. In addition, thematic spatial data and information are already available with covering 100% of the Province area, including a map of administrative boundaries, spatial planning map, detailed spatial plannig map, transport/road network map and utility system map.

On the other hand, a cadastral map is not available and some thematic spatial data and information are below 50%, namely, land and property tax map and detailed spatial plan maps. Spatial data and information below 50% indicates the limited availability of basic spatial data and which covers only a small percentage of the area of the Province area.

BAPPEPROV NTB does not have the authority to produce cadastral maps which is done by the Indonesian National Land Agency (*Badan Pertanahan Nasional*, BPN). However, when BAPPEPROV NTB requests cadastral maps, spatial data and information sharing can be carried out through the un-official bureaucratic procedures. it means based on friendship relationships. As the Senior Management Staff Member of BAPPEPROV NTB said in an interview:

> *"BAPPEPROV NTB does not hold a cadastral map because it is not directly related to the responsibility of the scope of the Province. However, if we ask for the cadastral data, we can get it quickly from BPN. If BAPPEPROV NTB requested the land use map, the BPN would give the cadastral map without a formal letter. The spatial data transaction occurred on friendship relationships"*

(BAPPEPROV NTB Senior Management Staff; Interview at 9th March 2015)

The I-SRI study also shows that all spatial data and information in the provincial government has been stored in a digital geo-referenced format and is available to the public through the official provincial website.

The scope of published thematic spatial data covers:

- Distribution of power generation with a map scale of 1: 250,000;
- Distribution of electrical substations with a map scale of 1: 250,000;
- Distribution of clean water reservoirs with a map scale of 1: 250,000;
- Distribution of transportation hubs (airports, ports, bus stations) with a map scale of 1: 250,000;
- River network with a map scale of 1: 250,000;
- Road network with a map scale of 1: 250,000;
- Distribution of land cover with a map scale of 1: 250,000;
- Distribution of forest area with a map scale of 1: 250,000;
- District administration boundary with a map scale of 1: 250,000.

The available spatial data has been provided at http://dashboard.bappeda.ntbprov.go.id/palapa_v2/web/peta. In general, the spatial data and information in the Province of West Nusa Tenggara spatial database management is adequate, but there is a lack of standard data types. Hence, the future need for the preparation of standardisation and dissemination of published spatial data types to create better governance in SDI.

Human resources

The details of human resources aspects of assessment of preparation for SDI in the Province of West Nusa Tenggara can be seen in the following Table:

Table 9.2 Human Resource Capability to Manage Spatial Data and Information in The Province of West Nusa Tenggara

No	Human resources readiness	Availability	Note
1	Staff capability in operating GIS	Available	3-5 staff have GIS skills
2	Staff ability in operating a geospatial server (server with publication and distribution facilities geospatial data and information)	Available	2 staff can operate a GIS server
3	Staff's educational qualifications in GIS, geomatics, geography	Not Available	The ability of personnel to operate spatial analysis obtained through GIS training and self-taught learning GIS.
4	A programme to improve the quality of personnel in the management of geospatial data and information	Available	The programme to improve the quality of personnel is conducted through a GIS training

The I-SRI Report (BIG, 2014c) reveals that the human resources aspect of the Province government pertaining to spatial data and information use and management for the spatial planning process is adequate. There is more than one person able to operate GIS and a geospatial server (three to five people can operate GIS and two staff can operate geospatial server).

GIS knowledge skills are acquired through GIS training and self-taught learning. The Province government has included in its annual work agenda for GIS training programme to improve skills of personnel in spatial data management with the internet support.

The history of geospatial expert requirements in the Provincial government of West Nusa Tenggara began with the implementation of the LREP and MREP projects. When the two projects were completed in 2000, the personnel with knowledge of GIS and cartography resigned from the civil service and this meant there was a lack of personnel to handle spatial data and information management in the provincial government. In 2005, the Province government acquired new staff with geospatial knowledge. Since 2005, the Province government has re-managed the spatial database to support the government works in implementing the provincial planning and development programmes.

In general, the issue of staff with GIS and cartography qualifications in managing spatial data and information in the Province of West Nusa Tenggara is similar to the Provicne of East Java case study. Staff get promoted or transferred to other work units, and the replacement personnel managing spatial data have less GIS and cartography knowledge, leading to a decline in spatial data and information performance.

The questionnaire of I-SRI study has described that the Province government of West Nusa Tenggara has been involved in GIS training programme to improve spatial data management. In an interview with BAPPEPROV NTB Senior management staff member said that in the year 2012-2014, BAPPEPROV NTB made a special request to the German NGO, *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) from German for technical support to enhance GIS capability amongst provincial personnel.

"For your information, in the year 2012-2014, BAPPEPROV NTB asked for special technical support for mapping from GIZ from Germany. Why GIZ? Because GIZ offers GIS training programmes. In this training, spatial data that initially stored on the hard disk has been transformed to storage using Cloud computing."

(BAPPEPROV NTB Senior Management Staff; Interview at 9th March 2015)

The special request for this GIS training was made in terms of promoting good governance by implementing e-Governance in the open data context. In this activity, provincial government staff have been trained to build a spatial database using OSM, QGIS and ArcGIS Online and have transferred spatial data which were previously stored in hard disk to the Cloud computing system.

Technology

The details of the assessment of the technological aspects of the Province of West Nusa Tenggara can be seen in the following table:

Table 9.3 Technology Capacity to Manage Spatial Data and Information in The Province of West Nusa Tenggara

No	Technology readiness aspect	Availability	Notes
1	GIS Software	Available	Both commercial and open source GIS software have been provided
2	Hardware to support spatial data and information management		
	Personal Computer (PC)	Available	There are 3 PC units for spatial data and information management
	Server	Available	There is 1 Server for spatial data management

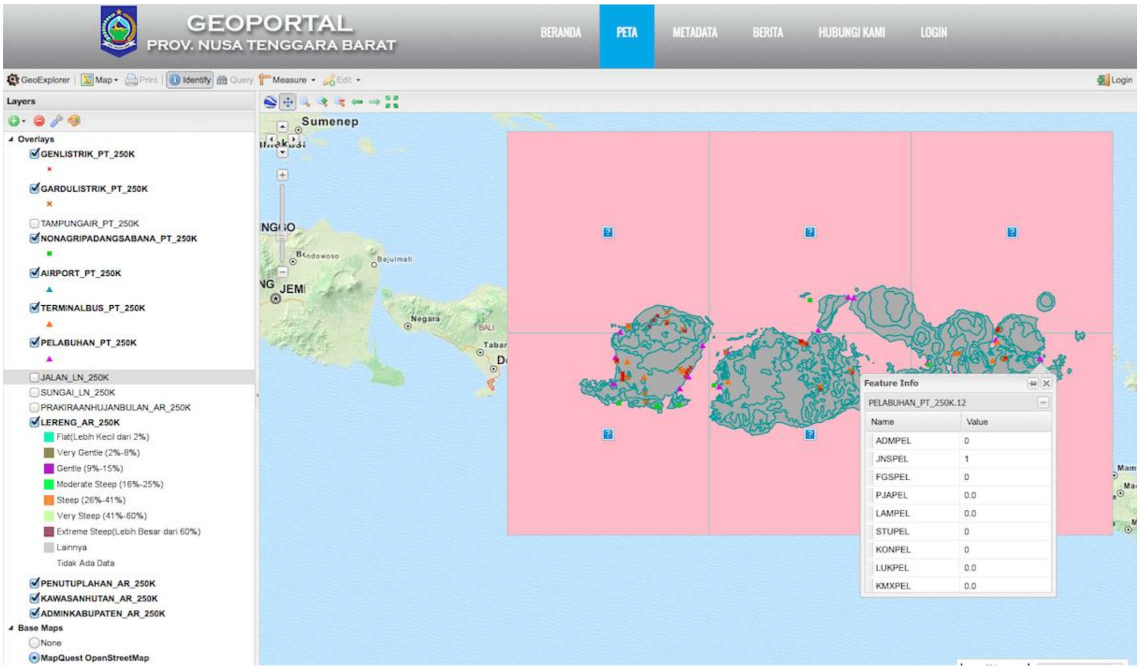
	Special room for spatial data and information server	Available	
3	Internet subscriptions to support spatial data and information sharing	Available	There is Internet subscription with a bandwidth of> 3 Mbps
4	Geoportal	Available	
5	Spatial data catalogue system	Not Available	
6	Availability of a spatial data catalogue online system	Not Available	
7	Metadata storage with maps and digital database	Not Available	
8	Metadata to compile spatial data catalogues	Not Available	

The I-SRI Report (BIG, 2014c) reveals that the technological aspect of building SDI in the Province government is very good. This is characterized by the availability of GIS software, a geoportal, personal computers, servers, a special room for storage server and subscriptions to the internet. However, there are still problems in relation to a lack of the catalogue system preparation to determine the list of spatial data availability.

The research survey shows that the personal computers in the BAPPEPROV NTB office have been equipped with GIS software for spatial data management along with the server as the official spatial data information storage and back-up. The primary spatial data and spatial information storage in the Province of West Nusa Tenggara are stored in Cloud computing by renting a private sector domain system.

> *"For the geoportal, we are not installing the server, due to the constraints of electrical power and internet bandwidth capacity. Therefore, we are using Cloud computing system. We rented a domain from one private Cloud computing provider for saving our spatial data."*
>
> (BAPPEPROV NTB Senior Management Staff; Interview at 9th March 2015)

The investigation from the fieldwork through interviews, content analysis of spatial policies and reports as well as observations indicates that the provincial government has released spatial data to the public including the distribution of essential public services in the Province (i.e. transport hubs locations). All the official West Nusa Tenggara spatial data and information can be accessed through official geoportal in the link http://dashboard.bappeda.ntbprov.go.id/palapa_v2/web/peta (See Figure 9.3).



Source: http://dashboard.bappeda.ntbprov.go.id/palapa_v2/web/peta

Figure 9.3 The Province of West Nusa Tenggara Spatial Data Sharing Geoportal

Users who want to request official spatial data the Province can download it in raster format (JPEG, PNG or TIFF) only. Editing a graphical spatial data format is restricted to the official government actors who have authority in order to avoid the misuse of the official spatial data.

Examination of the Province of West Nusa Tenggara geoportal shows that the geoportal interface does not function as spatial data sharing platform yet, but the platform interface tends to a WebGIS application. However, interviews for this research indicate the Province government is still upgrading the system, so that in the future, the existing geoportal can serve as spatial data sharing portal. Furthermore, the public will be able to download spatial data in digital vector format, such as shapefile (.shp).

Organisation

Details of the institutional aspect of the assessment of the Province of West Nusa Tenggara can be seen in the following Table:

Table 9.4 Organisational Capacity to Manage Spatial Data and Information in the Province of West Nusa Tenggara

No	Organisational readiness	Availability
1	Availability of a cross-agency coordination / steering committee for spatial data creation, management and utilization	Available
2	Availability of a special GIS unit	Available

The I-SRI Report (BIG, 2014c) indicates the institutional aspect of the Province of West Nusa Tenggara SDI is adequate: there is coordination amongst institutions, and a special unit that handles spatial data management.

The special unit of the provincial institution that manages spatial data and information is merged into the unit of statistics, data collection and information services under BAPPEPROV NTB. The province has established a special unit, for data dissemination, called the Center for Information and Documentation Management (*Pejabat Pengelola Informasi dan Dokumentasi*, PPID). As noted earlier, according to the interview, spatial data sharing between government institutions can be conducted informally on the basis of friendships without going through official bureaucratic procedures.

One constraint on data sharing in the provincial government is the lack of initiative from the government sector services to publish their official data online. Even though the PPID has built a portal for sharing official data and information, along with the provision of a username and password for each government service to upload public data, most institutions do not use it. In order to encourage communication the use of the data sharing portal, PPID collected data through face-to-face discussion with provincial staff, and put this on the PPID portal. This information was obtained in an interview with PPID Senior management Staff.

> *"The obstacles that we have encountered, although we have already provided the facility with a username and password for perform data sharing, most of the provincial government institutions do not use it, because there are too many applications made by the central government agencies. it was confusing for them to select the priority programme. Thus, we requested the data manually (i.e face-to-face request)"*

(PPID Senior Management Staff; Interview at 9th March 2015)

In general, the constraints of spatial data sharing from organisational aspects occurred due to lack of willingness to share official public data. This situation requires a solution with the right strategy, with the support of regulatory stipulation. Given that all government services that produce spatial data have a legal duty, such regulations are urgently needed. These are discussed in the next section.

Policy

Details of the assessment of the policy elements of preparation for SDI in the Province of West Nusa Tenggara can be seen in the following Table:

Table 9.5 Policy Support to Manage Spatial Data and Information in The Province of West Nusa Tenggara

No	Policy readiness	Availability	Notes
1	There is a strategic for development of SDI	Available	
2	Spatial data management follows the Indonesian national standards or technical specifications determined by	Not available	

	the Ministry / agency		
3	There are formal mechanisms for spatial data sharing between government institutions	Available	
4	There is a regulatory mechanism for authorizing public use of spatial data	Available	
5	There is a regulation related to the spatial data use and management	Available	
6	There is a Governor regulation concerning utilization and management of spatial data	Not Available	

Similar with the previous case for the Province of East Java, financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization. The financial support for SDI operationalization in government agencies consists of data, software and hardware procurement, maintenance and internet subscription. Details of the financial allocations of SDI operationalization in the Province of West Nusa Tenggara can be seen in Table 9.6.

Table 9.6 State Budget to Manage Spatial Data and Information in The Province of West Nusa Tenggara

No	Activity	Budgeting system			
		Routine		incidental	
		APBD	APBN	APBD	APBN
1	Spatial data procurement			✓	
2	Software procurement	✓			
3	Maintenance / updating spatial data	✓			

4	Metadata procurement (information about spatial data)			✓	
5	System Maintenance / development	✓			
6	Internet subscriptions for spatial data sharing activities	✓			

The I-SRI Report (BIG, 2014c) indicates that the policy aspect of building SDI in the Province of West Nusa Tenggara is in eligible condition. This can be seen from: the presence of a SDI strategic plan or roadmap development; Spatial data management already adheres to Indonesian national spatial data standards specifications; there is a formal mechanism for public spatial data sharing; there is a regulatory mechanism for authorizing public spatial data use; there is a regulation related to spatial data usage and management.

The readiness of policy elements for building the provincial SDI is supported by the availability of the financial aspects: anwers to the questionnaire show that there is a regular annual budget allocation from the central budget for provincial spatial data development and management.

Fieldwork information indicates that the Province of West Nusa Tenggara has implemented a “one official the Province data policy” called “One West Nusa Tenggara data policy” in September 2014 with the establishment of the data centre “Bale ITE” with the help of AIPD (Australia Indonesia Partnership for Decentralization). The “One West Nusa Tenggara data policy” creates a data bank to support planning and development activities in the Province through a single reference database and portal that integrate all the provincial data; that is spatial, statistical and texts data created by all government sector services in the Province.

Although SDI development by this provincial government is said to be ready, there are some limitations in terms of the details of spatial data and information provision (i.e. spatial data with map scale 1:500 – 1:10,000). One of the alternative ways to overcome this shortage of large-scale official spatial data provision could be by involving citizens in voluntarily interactive community mapping through the OSM platform (to be discussed in the following section). This point is supported by the interview with BAPPEPROV NTB Senior Managament Staff.

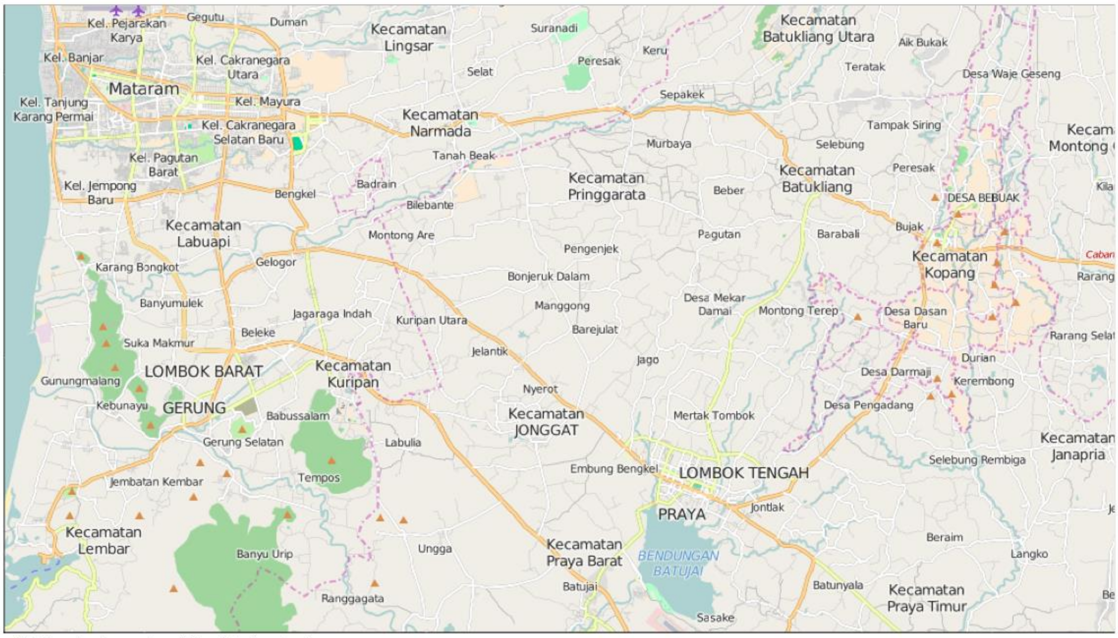
> *"The challenge is [that] in the past; spatial information was an exclusive product. However, now this is actually not exclusive, because we can collect data from other sources. For example, I provided GIS training in the form of village-based planning. And used OpenStreetMap platform, if they do not have the internet, we printed out the map and validated in the real situation in the field. The results of the validation, we can input into OSM applications."*
> (BAPPEPROV NTB Senior Management Staff; Interview at 9th March 2015)

9.2.4 VGI performance in the Province of West Nusa Tenggara

Investigation of VGI activities in the Province of West Nusa Tenggara showed that VGI community mapping activity was first undertaken in 2011-2012 in three regencies and two urban areas, namely North Lombok Regency, Central Lombok Regency and West Lombok Regency, also Bima and Dompu urban areas respectively. The VGI community activities were conducted through the ACCESS project (Australian Community Development and Civil Society Strengthening) with the main purpose of engaging local civil society in community mapping to build the local spatial database. (HOT, 2012a).

This pilot was the principal endeavour to utilize OSM to collect spatial data and information of existing urban infrastructures conditions. The project then used the spatial data to explore models in order to predict what might occur if a catastrophe happened in a particular area. By utilising VGI group mapping, the model can estimate the damage to infrastructure buildings and so on that might be affected by disaster events (HOT, 2012a).

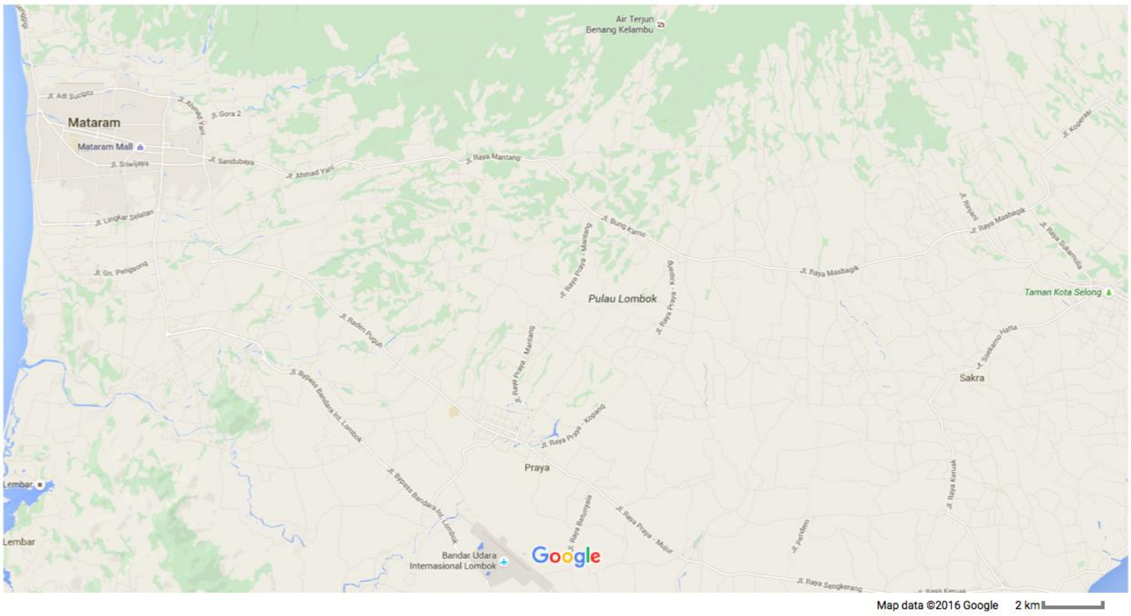
In general, VGI activities by the OSM community have been successful in establishing a spatial database, which can be seen from the comparison of spatial database on the OSM platform and Google maps in Figure 9.4 and Figure 9.5



http://openstreetmap.org/copyright http://openstreetmap.org

Source: OSM, 2016

Figure 9.4 Spatial Database in Lombok Island Built by OSM Community



Source: Google Maps, 2016

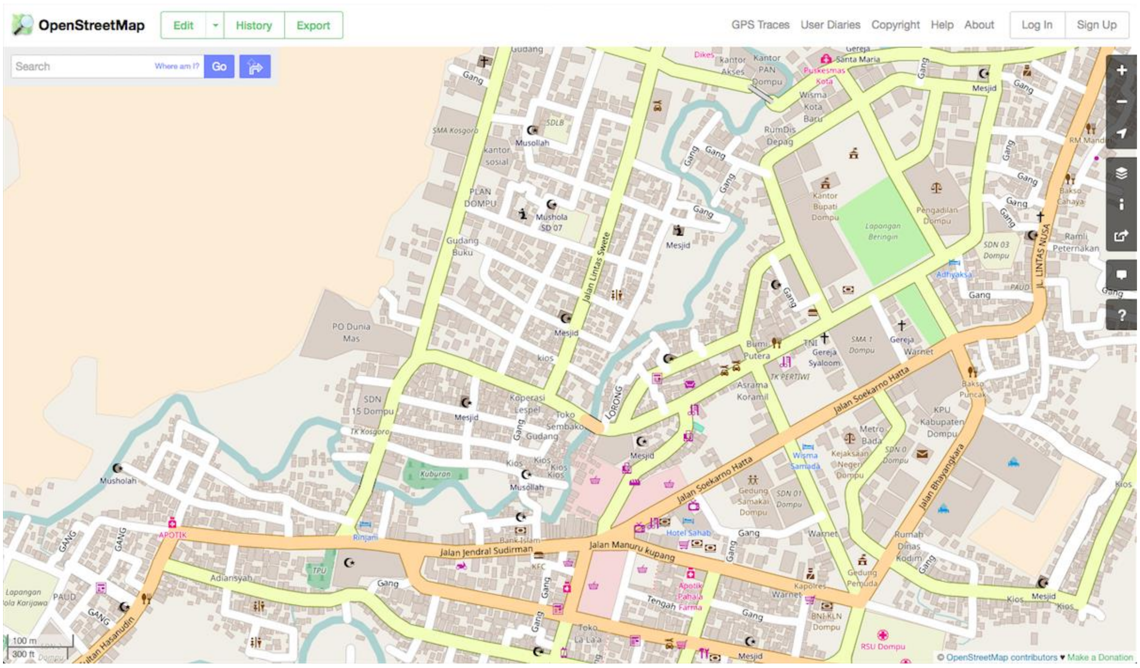
Figure 9.5 Spatial Database in Lombok Island Built by Google maps

The maps created by the OSM community contain higher numbers of digitized spatial objects and more spatial features than those in Google maps. To explore the value of spatial database development by the OSM community, this section discusses a case study of an ACCESS-targeted location in the Province of West Nusa Tenggara, namely, the District of Dompu in Dompu Regency. The area was selected for examination based on this interview with the senior management staff of HOT Indonesia.

> *"There is an interesting story about VGI communities in Sumbawa, very enthusiastic to map out their territory. There is one village in Dompu Regency who mapped out all their buildings by their village community. Seeing the interactive community mapping results can produce good spatial data quality, the official local government, through BAPPEDA Dompu [The Planning board of Dompu Regency] provided funds to the local community up to IDR 1 billion to map all villages under Dompu Regency using OSM."*

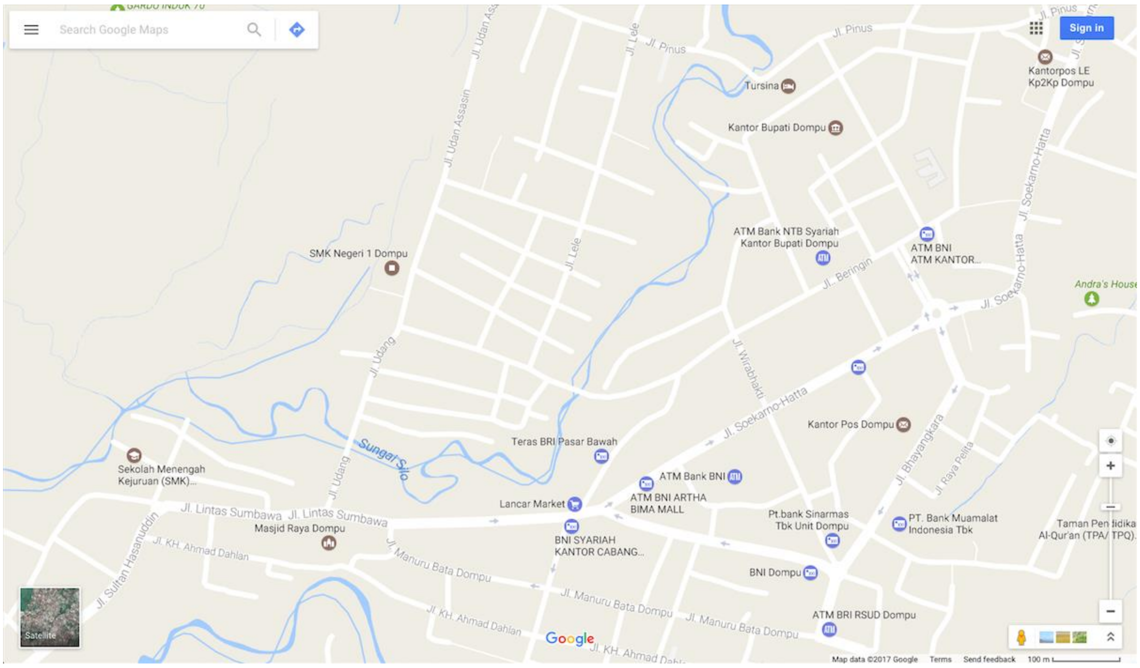
(HOT Indonesia Senior Management member: Interview at 6th February, 2015)

Comparison of OSM and Google maps for Dompu shows that the number of spatial objects appearing on the OSM platform, exceeds the numbers on the Google map platform (See Figure 9.6 and 9.7)



Source: OSM, 2017

Figure 9.6 District of Dompu in OSM Platform



Source: Google Maps, 2017

Figure 9.7 District of Dompu in Google Maps Platform

Based on interviews with one HOT Indonesian organizer, it appears that District of Dompu citizens are enthusiastic about participating in spatial database activity on the OSM platform because the initiation project for building spatial database was attended by community leaders or public figures in their community.

Understanding the important impact of the spatial database for development purposes was not only useful for disaster mitigation but also for supporting socio-economic activities in their community. The community leaders who attended the initiation of the ACCESS project took immediate action by involving their community members in the spatial database development. The village community leaders instructed their community to learn something new and useful so that community awareness is raised in the local community to voluntarily build a spatial database.

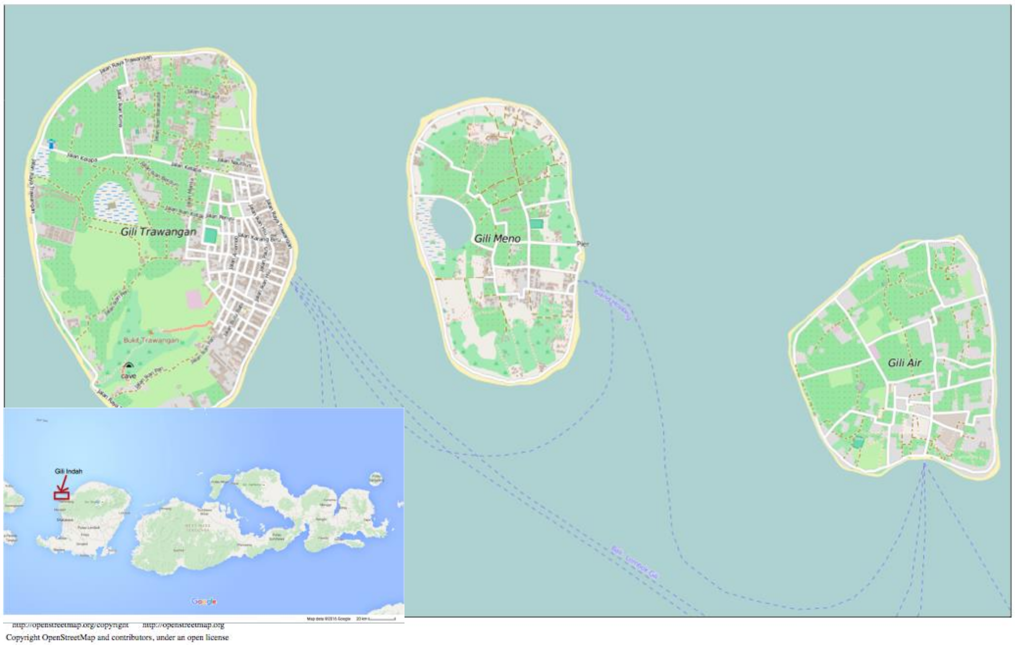
The phenomenon of the success of community involvement in building the spatial database in District of Dompu can be explained by the 'community of practice' theory (Wenger,1998). Wenger argues that the community who understand the importance of learning external factors, - in this research context, building a spatial database - will create awareness by itself to practice new usefull external factor what they earned to improve surround their community in daily social life.

The above phenomenon can also be explained through Coleman *et al*.s' (2009), VGI behavior study, in this study. VGI activity could achieve success in building a spatial database in a particular community when each person had at least one of seven aspects of VGI voluntary behaviour: altruism; personal or professional interest; intellectual stimulation; social reward; enhanced personal reputation; pride of place; independent self-expression and personal investment.

The results of the interactive mapping which were conducted by VGI community in Dompu were of excellent quality and provided benefits to support the Dompu Regency government's agenda. In 2013, the Dompu Regency Government through BAPPEDA Dompu, provided a budget allocation of 1 billion Indonesian Rupiah (IDR 1,000,000,000 or £ 50,000 (£1 = $\pm$ IDR 20,000 in 2013)) to build the spatial database which covers the entire Dompu Regency in 2013.

The success story of community engagement in developing interactive mapping activity in District of Dompu, the Province of West Nusa Tenggara, is one example of the best qualities of the group mapping system. Facilitators begin with particular projects for which they need to use OSM. There is a reason to continue mapping and these projects are significantly more inclined to proceed than those initiated by the OSM competition. The success of VGI in building the spatial database in Dompu Regency in 2011-2013 had a positive impact on the spatial database development by another VGI community in the Province of West Nusa Tenggara. This can be seen with the spatial mapping of tourism areas in Gili Indah (See Figure 9.8).

Interactive mapping voluntarily conducted by the Province of West Nusa Tenggara civil society has been facilitated by the Provincial government. It was subsequently integrated into the official website of the Province of West Nusa Tenggara in the link http://bappeda.ntbprov.go.id/data-dan-informasi/maps-online/peta-desa-gili-indah/ .



Source: http://bappeda.ntbprov.go.id/data-dan-informasi/maps-online/peta-desa-gili-indah/

Figure 9.8 Gili Indah Spatial Database Development by the OSM Community

9.3 Spatial planning and spatial data management in Mataram Municipality

This section discusses spatial planning and spatial data management in Mataram Municipality. examining aspects of SDI readiness under Mataram Municipality management and VGI development.

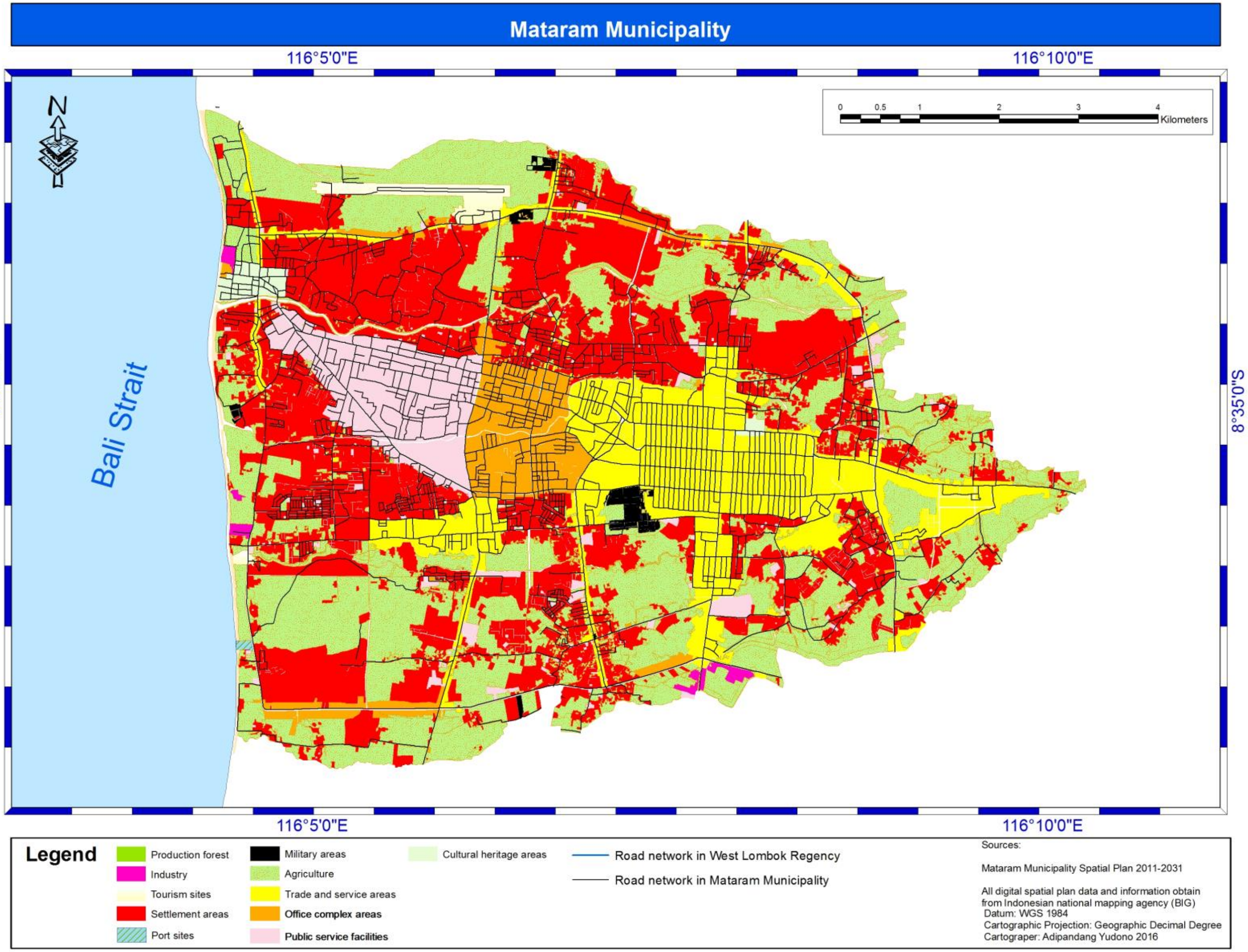
9.3.1 An overview of spatial planning in Mataram Municipality

Mataram is the capital city of the Province of West Nusa Tenggara. As the capital city of the Province, Mataram functions as the centre of government, education, trade, industry and services, and is currently being developed as a tourism destination.

The municipality is made up of 6 districts (*kecamatan*): Ampenan, Cakranegara, Mataram, Pejanggik, Selaparang, and Sekarbela with 50 sub-districts (*kelurahan*) and 297 villages (*desa*). The municipality has a total area of 61.30

km^2 with the boundaries with West Lombok Regency in the North, East, and South, and the Lombok Strait in the west (See Figure 9.9).

Mataram Municipality Spatial Plan (RTRW Mataram) was ratified under Mataram Municipality Regulation No.12 of 2011 for the planning period of 2011 – 2031, with spatial plan maps approved by BIG (See Chapter 5, Figure 5.10 for the Municipality spatial planning procedure from proposal to enactment) .



Source: BIG 2016, processed by the researcher

Figure 9.9 Mataram Municipality

9.3.2 Spatial data usage under the government of Mataram Municipality management

Spatial data usage in Mataram Municipality began in 2006 with the help of the German NGO DAAD (*Deutscher Akademischer Austauschdienst*) which developed a strategic plan with a focus on the education sector. When preparing the strategy, the municipality government applied GIS to identify educational facilities and infrastructure.

At the beginning of spatial data use in the municipality, the Mataram Municipality through Mataram Municipality Planning Board (BAPPEKO Mataram) conducted GIS training by inviting junior geospatial experts from Germany to be involved in the mapping of the tsunami disaster in Aceh in 2004. After completing the mapping operation in Aceh, the German experts moved to Mataram. As the strategic plan for education project in Mataram Municipality was already complete, the GIS unit was established under the Sub-Department of Physical and Infrastructure Planning (*bidang fisk dan prasarana*) in BAPPEKO Mataram.

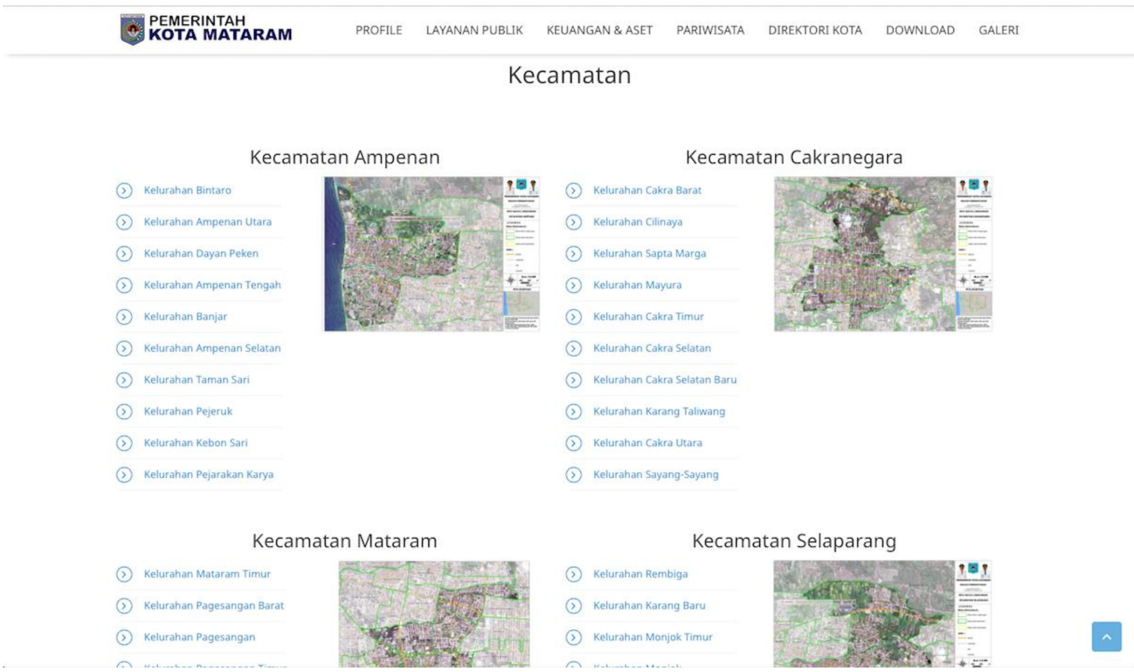
The GIS trainers thought that the spatial analysis was for other government sector services as well, and the GIS unit in BAPPEKO Mataram invited other government sector services to contribute to GIS training. It was expected that the other sectors would contribute by producing and providing spatial data in accordance with their sector's duties, upon which the spatial database in Mataram Municipality could be built. However, most of the GIS training participants went back to work in administration in their original government working units where the daily tasks were more important than spatial data management. Thus the Mataram municipality spatial database was unrealised.

In terms of spatial data and information procurement projects, in 2013, the Municipality undertook identification of slum areas in the municipality. At this time, BAPPEKO Mataram invited companies to tender for planning consultancy for the project. However, the outcomes of the project only provided maps and did not include digital format: in other words, this project did not contribute to the building of a spatial database for Mataram Municipality.

Based on information from interview with middle management staff in March 2015, spatial data management activities under the GIS unit in BAPPEKO Mataram still undertook digitising and updating the roads and bridges themes, because these themes are the foundation layer for the other spatial plans in the Municipality.

> *"We are not updating spatial data yet; the last updating was performed around 2009-2010. However, we are still maintaining updating of the subject of roads and bridges. Both themes are kept up to date, because, for us, they are the foundation for the spatial planning application."*
>
> (BAPPEKO Mataram Middle Management Staff; Interview at 9th March 2015)

Observation of the GIS unit in BAPPEKO Mataram indicated that spatial data usage in the municipality government is not yet adequate, because the publicly spatial information are just displays of kecamatan administrative boundaries in raster map format (See Figure 9.10)



Source: http://mataramkota.go.id/peta.html

Figure 9.10 Display of the District Administrative Boundaries in Raster Map Format Under Mataram Municipality Authority.

In exploring the readiness of Mataram Municipality for building the SDI, the next section discusses the assessment of spatial data management performance in the municipality government.

9.3.3 SDI under Mataram Municipality government management

SDI in Mataram Municipality will be examined by transforming the I-SRI quantitative appraisal methods into qualtitative criteria. The qualitative assessment method in this study is carried out by assessing ' available ' or ' not available ' answers for each of the I-SRI variables (data, human resources, technology, organisation and policy). Analysis related to the readiness of SDI development is carried out based on interviews, observations and content analyses of policy and internal reports.

The results of the I-SRI Report (BIG, 2014c) show that Mataram Municipality is ranked 14th out of 118 cities and counties (See Appendix E). Details of spatial data infrastructure readiness in the government of Mataram Municipality will be discussed for each SDI component.

Data

The details of the assessment of standards and data aspects of SDI readiness in Mataram Municipality can be seen in the following Table:

Table 9.7 Spatial Data Availability in Mataram Municipality

No	Spatial data readiness	Availability	Coverage
1	Topographic (*Rupabumi*) map	Available	100%
2	Land parcel map	Available	100%
3	Land and property tax map	Available	100%
4	Administrative boundaries map	Available	100%

5	Spatial planning map	Available	100%
6	Detailed spatial planning map	Available	100%
7	Road network map	Available	100%
8	Urban and regional infrastructures map	Available	100%

All spatial data has not transformed into digital format yet; Spatial data has not been published for public yet.

The I-SRI study (BIG, 2014c) shows that basic and thematic geospatial data and information for spatial planning is already available, with 100% coverage of the total Mataram Municipality area. However, spatial data and information are not stored in digital format and cannot be accessed by the public.

The research survey in 2015 found that spatial data for the Municipality did not exist. Furthermore, the municipal government does not have a geoportal or WebGIS to disseminate spatial data and information. Spatial data sharing is not occurring in Mataram because of the unwillingness of the institution to share spatial data and information.

Information obtained from fieldwork relates to the readiness of the SDI and spatial data management in government sector services is not functional. This is because the duties of each office did not include the development of the spatial database for development sector analysis. As one of BAPPEKO Mataram middle management staff said in an interview:

> *"A spatial database is not ready yet. This is because the GIS unit in BAPPEKO Mataram is not an independent working unit. As part of the physical and infrastructure planning department, the jobdesks are more concerned with facilities and infrastructure planning and development programmes rather than concentrating on geospatial data management only."*

(BAPPEKO Mataram Middle Management Staff; Interview at 9thMarch 2015)

Human resource

Details of the assessment of human resources aspects of SDI readiness in Mataram Municipality can be seen in the following Table:

Table 9.8 Human Resource Capability to Manage Spatial Data and Information in Mataram Municipality

No	Human resources readiness aspect	Availability	Note
1	Staff capability in operating GIS	Available	There is one staff member with GIS skills
2	Staff capability in operating a geospatial server (server with a publication and distribution facilities for geospatial data and information)	Not available	
3	Educational qualifications in GIS, geomatics, geography	Available	The personnel who manage geospatial data have graduated from geography / geomatics / informatics subjects.
4	Government programmes to improve personnel skills in spatial data and information management	Available	The programme which aims to improve the personnel quality has conducted GIS training

The I-SRI Report (BIG, 2014c) indicates that the human resources aspect of the municipality government pertaining to spatial data and information analysis for the spatial planning process is inadequate. For instance, there is only one personnel who able to operate GIS.

GIS knowledge and skills are acquired through formal education, in which personnel are required to have academic qualifications in surveying/ geomatics/ geography. Other skills are obtained through study and courses / training in GIS. To improve personnel performance in data and geospatial information management, the municipality government has included GIS training programmes in its annual government budget.

The survey for this research showed that there was only one staff member who had GIS knowledge and skills. As in the other governments studied, the system of promotion and personnel changes produces inconsistent spatial data and information performance.

In order to improve human resources capabilities in building spatial databases, the Municipality conducted GIS training in 2010, inviting some government sector services under Mataram Municipality authority, such as public works, health, fisheries and maritime affairs, to participate. However, government sector services policies lacking concern with spatial data development, the staff delegated to do the GIS training did not practice their lessons. They went back to work in daily administration and neglected spatial data management tasks.

> *"At the beginning era of GIS unit establishment in our office, we invited other sectoral municipal government agencies /SKPD to be involved in GIS training. It was expected that, in the future, the results from the training would make contributions to generate spatial data by each department. However, because it is constrained by the sector departments which do not have specialized personnel to operate GIS, spatial data management in the municipal government does not exist."*

(BAPPEKO Mataram Middle Management Staff; Interview at 9thMarch 2015)

In addition, the staff members with GIS skills obtained promotions or were transferred to other work units. Their replacement by personnel with less GIS and cartography skills weakened spatial data and information performance.

Technology

The details of assessment of the technological aspects of Mataram Municipality preparation for SDI can be seen in the following Table:

Table 9.9 Technology Capacity to Manage Spatial Data and Information in Mataram Municipality

No	Technology readiness aspect	Availability	Notes
1	GIS Software	Available	GIS commercial software
2	Hadrware to support spatial data and information management		
	Personal Computer (PC)	Available	3 PC units for spatial data and information management
	Server	Available	1 server available
	Special room for spatial data and information server	Available	
3	Internet subscriptions to support spatial data and information sharing activities	Available	Internet subscription with a bandwidth of < 1 Mbps
4	Geoportal	Not available	
5	Spatial data catalogue system	Not available	
6	Spatial data catalogue online system	Not available	
7	Metadata storage with maps and digital database	Not available	
8	Metadata to compile spatial data catalogues	Not Available	

The I-SRI Report (BIG, 2014c) indicates the use of technology for building SDI in the municipality government is not adequate: there is no geoportal or catalogue system for spatial data or metadata; there is only one server available; and the internet bandwith is below 1Mbps. In addition the research survey found that although GIS software is installed on some PCs, it is not regularly updated.

In general, the support for the technological aspect of SDI in Mataram Municipality does not meet adequate levels of performance. The lack of support for the technological aspect occurred because of lack of financial and leadership support. These issues are discussed in the next section on organisational performance assessment.

Organisation

The details of the assessment of institutional aspects in Mataram Municipality can be seen in the following Table:

Table 9.10 Organisation Capacity to Manage Spatial Data and Information in Mataram Municipality

No	Organisation readiness aspect	Availability
1	A cross-agency coordination / steering committee for spatial data creation, management and utilization	Available
2	A special GIS unit	Available

The I-SRI Report (BIG, 2014c) indicates the institutional aspect of building SDI in Mataram Municipality is adequate. It is characterised by coordination amongst institutions and there is a special unit that handles spatial data management. However, the research survey found that the Municipality has not established a spatial data network hub and there is only one GIS unit under the Sub-Directorate of Physical and Infrastructure Planning in BAPPEKO Mataram.

The GIS unit in BAPPEKO Mataram was simultaneously established with the local government capacity building programme for spatial analysis by DAAD in 2006. It functions to manage the spatial database of the municipality relating to spatial planning and development activities. However, in daily operationalisation, the unit has a problem concerning spatial data and information management, because it is not an independent division. As a part of the Sub-Department of Physical and Infrastructure Planning , the GIS unit has undertaken multiple tasks of the government of Mataram Municipality that predominantly concern public services administrative affairs rather than technical spatial data production and provision.

As well as the GIS unit having to multi-task, poor spatial data management performance occurs due to lack of support from the institutional leader. Lack of institutional leadership support inclined to lessening spatial data management performance: there are inadequate human and financial resources, little upgrading of technology, and little willingness to share spatial data between government agencies.

> *"According to our boss, GIS is not considered as the municipal government's agenda priority. Therefore, when we want to develop geospatial data through technology updating and budget proposal concerning spatial data updating, the programme cannot be realized."*

(BAPPEKO Mataram Middle Management Staff; Interview at 9thMarch 2015)

Policy

Details of the assessment of policy aspects of SDI in Mataram Municipality can be seen in the following Table:

Table 9.11 Policy Support to Manage Spatial Data and Information in Mataram Municipality

No	Policy readiness aspect	Availability	Notes
1	There is a strategic plan or roadmap for development of spatial data infrastructure	Not available	
2	Spatial data management has followed the Indonesian national standards or technical specifications determined by the Ministry / agency	Not available	
3	There are formal mechanisms for spatial data sharing between government institutions	Not available	
4	There is a regulatory mechanism for authorising public spatial data use	Not available	
5	There is a regulation related to spatial data usage and management	Not available	
6	There is a Mayor Regulation concerning utilisation and management of spatial data	Not available	

Financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization. The financial support for SDI operationalization in government agencies consists of data, software and hardware procurement, maintenance and internet subscription. Details of the financial allocations of SDI operationalization in Mataram Municipality can be seen in Table 9.12.

Table 9.12 State Budget Support to Manage Spatial Data and Information in Mataram Municipality

No	Activity	Budgeting system			
		Routine		incidental	
		APBD	APBN	APBD	APBN
1	Spatial data procurement			✓	
2	Software and hardware procurement			✓	
3	Maintenance / update spatial data	✓			
4	Metadata procurement (information about spatial data)			✓	
5	Spatial data sharing system maintenance / development			✓	
6	internet subscriptions for spatial data sharing activities	✓			

The I-SRI Report (BIG, 2014c) indicates the policy aspect of building SDI in Mataram Municipality is not ready. It can be seen from the lack of relevant regulations governing spatial data management and sharing. The incidental state budget (usually the budget issued from reserved state budget for emergency situation) for spatial database development gives little assistance to the spatial data provision. The government conducts separate projects for new developments at various places and times in the municipality, some of which produce maps and some produce digital data, but none of these are coordinated or kept up to date.

Overall, Mataram Municipality does not yet have consistent policies for the management of spatial data and spatial data sharing, and this is made worse by the unwillingness that exists in each government agency to share data. As one of BAPPEKO Mataram middle management staff said in an interview:

> *What happens today is like each government agency holds their data. The ego of each sectoral institution to keep data means data sharing does not exist. The reason for them to keep data is because producing geospatial data is expensive so that the institution feels the loss if it is shared public or other government institutions.*

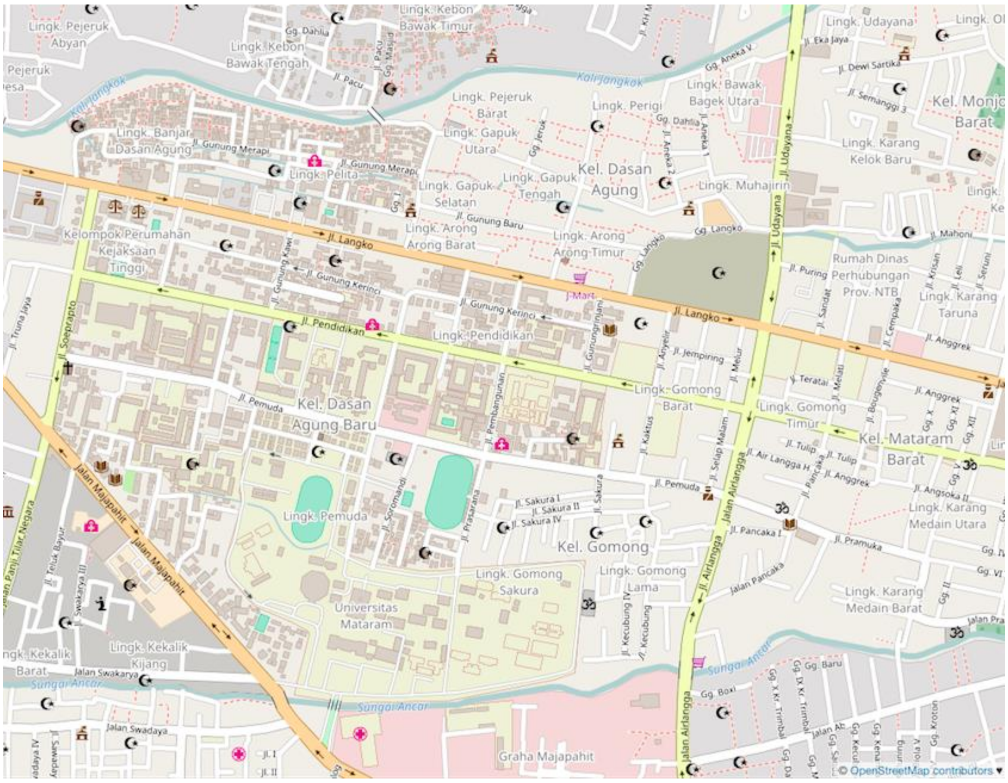
(BAPPEKO Mataram Middle Management Staff; Interview at 9th March 2015)

One solution to resolve the lack of SDI capacity in the Municipality government could be support from spatial data production by the VGI community. This is discussed in the following section.

9.3.4 VGI performance in Mataram Municipality

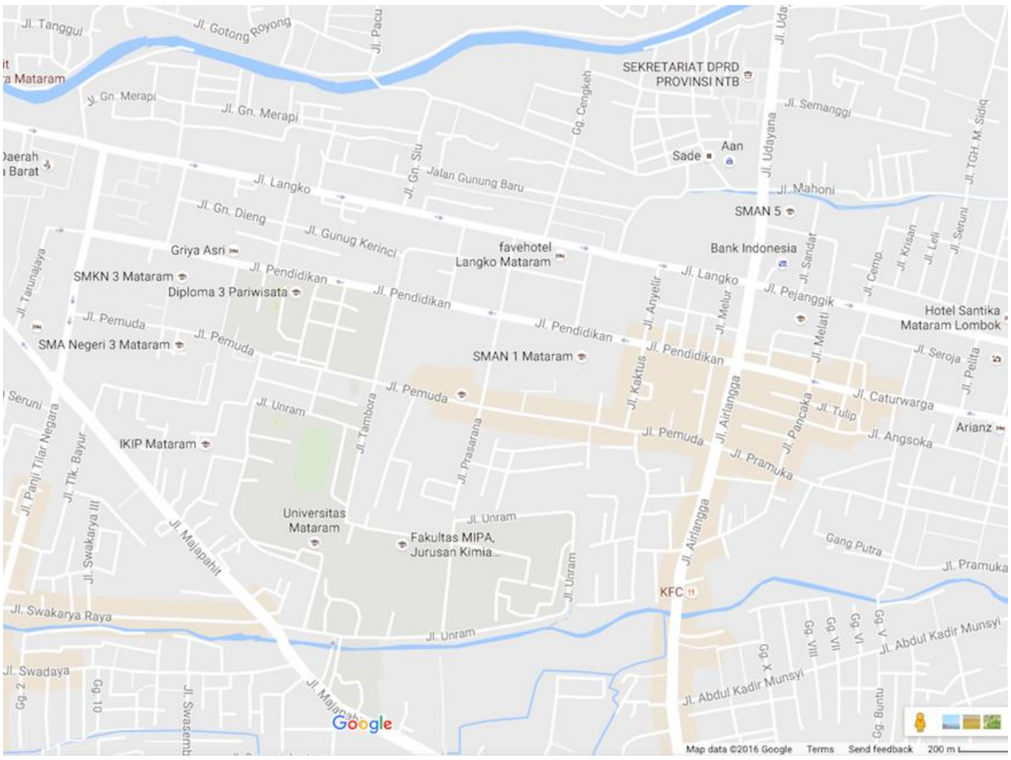
In terms of information obtained from the research fieldwork, the first spatial data development activities by VGI community through OSM platform in Mataram Municipality was carried out in 2011-2012. The research was conducted concurrently with the implementation of the ACCESS II project, that already described in session 9.2.5. Even though Mataram was not included as a selected ACCESS II Project target area, the Municipality was involved in the project as a region in which learning e-mapping was fostered.

Examination of the spatial database created by the VGI community in the Municipality shows that spatial data features digitised on the OSM platform are mapped in more detail and better quality suitable for basic planning and development analysis (see Figure 9.11) compared with the spatial visualisation provided by Google maps (See Figure 9.12).



Source: OSM, 2017

Figure 9.11 Spatial Database in Mataram Municipality Built by OSM Community



Source: Google Maps, 2017

Figure 9.12 Spatial Database in Mataram Municipality Built by Google Maps

A comparison of spatial visualization in both figures demonstrates the abundance and diversity of spatial objects in the OSM platform, compared to those in Google maps. This indicates that public participation in VGI activity in this municipality is fairly successful. There is a high level of public awareness of spatial database development and its significant tangible contribution to urban management. This is consistent with the ‘Community of practice’ theory (Wenger ,1998) and VGI voluntary behaviour aspects (Coleman et.al., 2009) discussed in Chapter 2.

The interactive community mapping in providing spatial data and information for Mataram Municipality is viable as a basis for spatial planning formulation, and there is a high potential for integration the official spatial data. However, it is clear that the decision to include crowd-sourced spatial data in the official spatial data management depends on policy management and organisational decisions, specifically the support of organisation leaders.

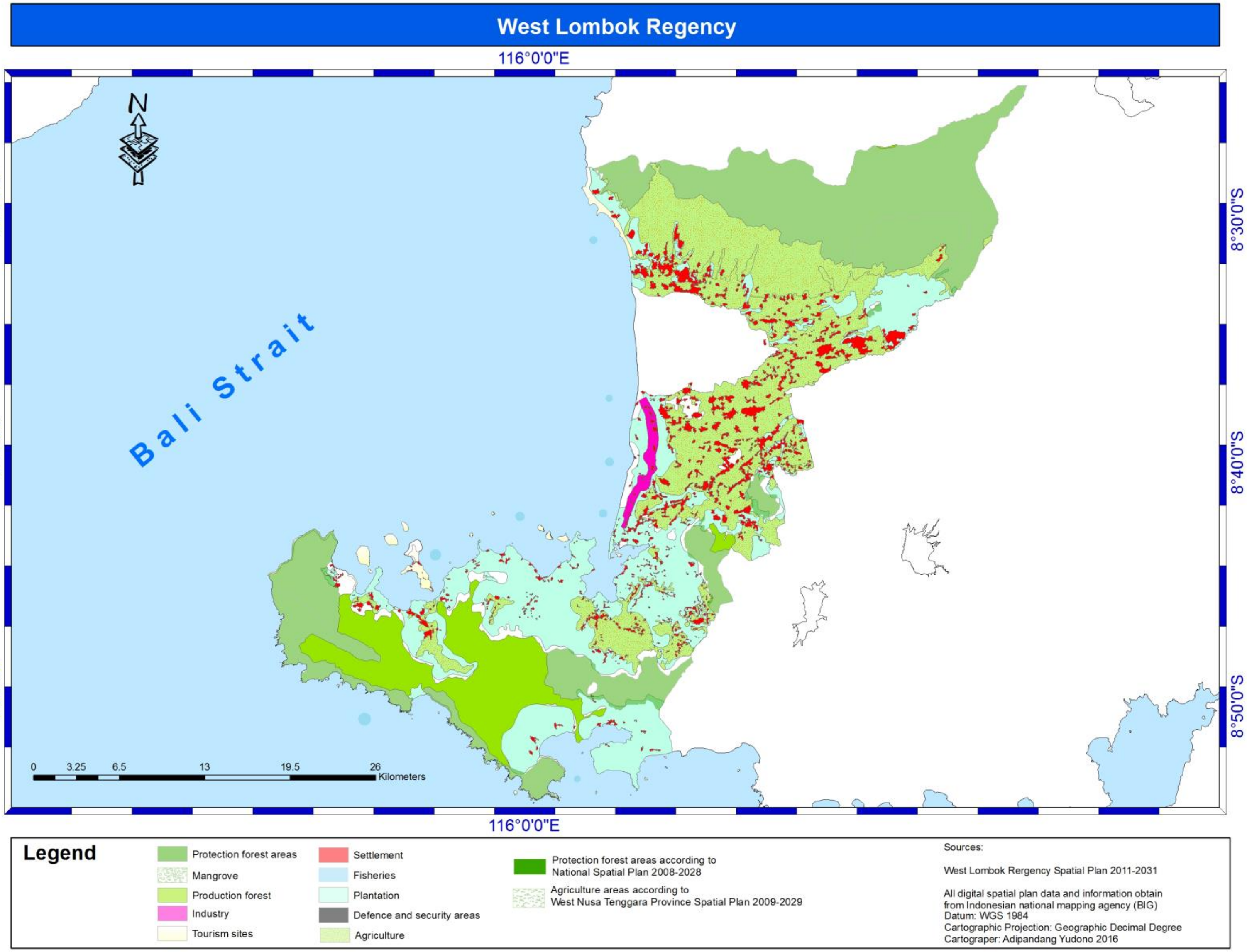
9.4 Spatial planning and spatial data management in West Lombok Regency

This section discusses spatial planning and spatial data management in West Lombok Regency. examining SDI readiness aspects under the regency government management and VGI development in the Regency.

9.4.1 An overview of spatial planning in West Lombok Regency

West Lombok is one of regencies in the Province of West Nusa Tenggara with a total area of 1,053.92 km^2. It has a border with Indian Ocean to the South; a land border with North Lombok Regency and Central Lombok Regency to the North and the East respectively; and a border with Lombok Strait as well as Mataram Municipality to the West.

West Lombok Regency is made up of 10 *kecamatan* with three *kelurahan* and 119 *desa* and 820 hamlets (*dusun*). Kecamatan Gerung is the capital city and centre of government of West Lombok Regency (See Figure 9.13).



Source: BIG 2016, processed by the researcher

Figure 9.13 West Lombok Regency

Information gained in fieldwork shows that the West Lombok Regency Spatial Plan (RTRW Lombok Barat) was ratified by West Lombok Regency Government Regulation No.11 of 2011 for the planning period 2011 - 2031. Like the case of the discrepancy in the spatial plan enactment procedure in Surabaya Municipality and the Province of West Nusa Tenggara, RTRW Lombok Barat has not received spatial plan maps recommendation from BIG. Examination of West Lombok Regency spatial planning documents reveals that the spatial plan map consultation undertaken by the Regency in 2016 is still under discussion in terms of thematic spatial plan maps stage.

9.4.2 Spatial data usage under West Lombok Regency government management

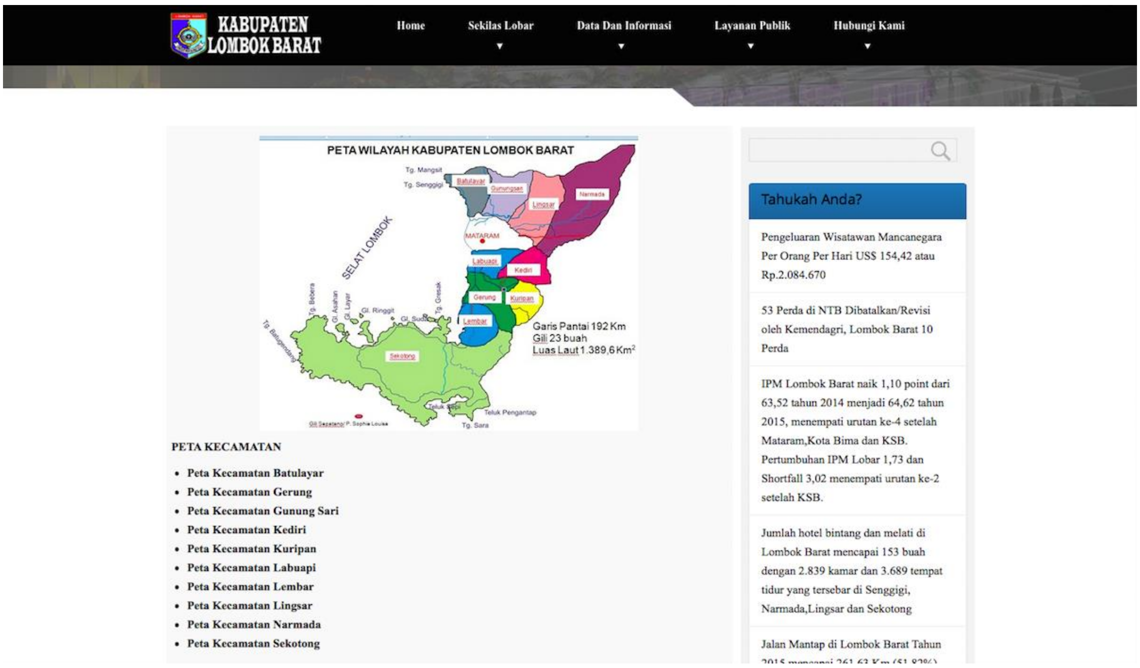
Spatial data usage and management in West Lombok Regency was initiated with the establishment of a GIS unit under the Technical Implementation Unit Regional Office (*Unit Pelaksana Teknis Daerah*, UPTD) under the West Lombok Regency Planning Board (BAPPEDA Lombok Barat) in the period 2006-2009. It is expected that GIS unit would be expanded to become an independent working unit under BAPPEDA Lombok Barat, called the West Lombok Regency Data Centre, able to coordinate spatial data management with the provincial data centre (PDP). However, as yet, the independent GIS unit of West Lombok Regency has not been established because of institutional limitations of human resources, technology and finance. In an interview, one of the senior management staff in BAPPEDA Lombok Barat

> *"We have the intention to establish an independent GIS unit in our Regency government agency, but we are unable to create such institutions, due to limited human resources, infrastructure in the form of hardware and software. Even if they are forced to establish the data centre, it won't work because of organisational inefficiencies and lack of budget support."*
>
> (BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

The West Lombok Regency GIS unit conducted GIS training run by forestry consultants in 2010 with twelve participants from different Regency government services (i.e. Public Works, BAPPEDA Lombok Barat, Transportation, Agriculture and Fisheries). This training was specialised for government staff with backgrounds in computer and mapping operations. However, as in the Mataram Municipality case study, the staff delegated to attend the GIS training did not practice their lessons because the government service departments lacked policies to support spatial data development. After the training, the staff went back to work in daily administration and were not concerned with spatial data management tasks. Therefore, the West Lombok Regency GIS unit failed to produce and provide the spatial database from each service sector.

Fieldwork revealed the lack of specific spatial database development activities in West Lombok Regency. In general, spatial database development has been inserted into thematic government programmes, such as the identification slum areas in West Lombok Regency. One of the project outcomes is spatial data visualization of the distribution of slums in the form of maps rather than in digital spatial data format.

Up to now, the Regency government has not owned geoportal or WebGIS for spatial data publication and only displays Kecamatan administrative boundaries through raster maps (See Figure 9.14).



Source: http://lombokbaratkab.go.id/sekilas-lobar/peta-lombok-barat/

Figure 9.14 Display of Administratve Districts in Raster Map Format under West Lombok Regency Authority.

In exploring the readiness of the Regency government for building SDI, the next section discusses the assessment of spatial data management performance.

9.4.3 Spatial data management under West Lombok Regency government management

Information obtained from the research fieldwork found West Lombok Regency was not included in the assessment I-SRI study by BIG and PPIDS UGM in 2013 and 2014. This is reinforced by interview with one of the senior management staff of BAPPEDA Lombok Barat, who confirmed that there had been no SRI survey. Thus, as in the Surabaya Municipality case study, the researcher investigated SDI readiness components in the survey for this research by adapting SRI methods using "Available" and "Not available " categories for each SRI components.

Details of SDI readiness in t West Lombok Regency are discussed for each SDI component - data, human resources, technology, organisation and policy - in the next sub-sections.

Data

The assessment of the readiness of data and standardisation in the government of West Lombok Regency was similar to the I-SRI method. The details of the standards and data assessment in the Regency can be seen in the following Table:

Table 9.13 Spatial Data Availability in West Lombok Regency

No	Spatial data readiness	Availability	Coverage areas
1	Topographic (*Rupabumi*) map	Available	100%
2	Land parcel map	Available	<50%
3	Land and property tax map	Available	50-100%
4	Adminisrative boundaries map	Available	100%

5	Spatial planning map	Available	100%
6	Detailed spatial planning map	Available	50-100%
7	Road network map	Available	100%
8	Urban and regional infrastructure network map	Available	100%

All of the spatial data has not been transformed into digital format yet; Spatial data has not been published for public through West Lombok regency government via official website.

Findings from the fieldwork questionnaire indicates that the readiness of basic spatial data and information in the Regency government is fairly adequate: the topographical and the administrative boundaries spatial plan, road network, and infrastructure network maps - cover 100% of the Regency area.

On the other hand, spatial data and information in the form of land parcel map and detailed spatial planning map are below 50%, indicating the limited coverage and availability of these elements of a spatial data base. In addition, Regency spatial data and information is not yet stored in digital format and cannot be accessed by the public.

The results of the research survey of March 2015 show that there is no the spatial data in digital format for the West Lombok Regency and there is no geoportal or WebGIS. The information can be taken from the interview.

> *“We have the intention to display spatial information on the official BAPPEDA Lombok Barat website. At present, spatial information can be downloaded by the public in JPEG format, but for spatial data with shapefile format, our Website technology does not support it yet.”*

(BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

Human resource

Details of the assessment of preparation of the human resources aspect of I-SRI in West Lombok Regency can be seen in the following Table:

Table 9.14 Human Resource Capability to Manage spatial data and Information in West Lombok Regency

No	Human resources readiness	Availability	Note
1	Staff capability in operating GIS	Available	3-5 staff have GIS skills
2	Staff capability in operating a geospatial server (server with publication and distribution facilities for geospatial data and information)	Available	2 Staff from personnel with GIS skills can operate GIS server.
3	Staff's educational qualifications in GIS, geomatics, geography	Available	The personnel who manage geospatial data have graduated from geography / geomatics / informatics subjects.
4	A programme to improve the quality of personnel in the management of geospatial data and information	Available	WebGIS training was conducted by BIG in 2013. However, the event was not the result of budgetary allocation.

The result of the research questionnaire indicate that human resources in the Regency government are fairly adequate to use and manage spatial data and information for the spatial planning process. The assessment can be justified because there is more than one staff capable of operating GIS and a geospatial server (between three and five staff are able to operate GIS and two of them can operate a geospatial server).

In terms of improving capabilities pertaining to spatial data and information management, GIS training was conducted in 2010. It was attended by 12 participants from various government sectoral services who had backgrounds in cartography and computer knowledge. In addition, they also attended WebGIS training for spatial data sharing run by BIG in 2013.

On the other hand, some of the constraints in terms of human resources, were similar to those in Mataram Municipality. Each trainee returned to their respective agency and did not put the training into practice because their work in public administration mainly concerns daily tasks rather than building the spatial database. Thus, human resource performance for SDI in this Regency is determined to be inadequate. As pointed out by senior management staff in BAPPEDA Lombok barat in interview:

> *"For BAPPEDA Lombok Barat, only two staff understand GIS. Actually, we have already provided GIS training in the frequent programme in our agenda to increase human resources skills. However, after they accomplished the training, all participants went back to work at their routine job desk. This situation becomes our constraint for managing Regency spatial data management."*

(BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

Technology

The assessment of the readiness of the technology aspect is similar to the I-SRI variables and parameters. The details of the technology assessment in West Lombok Regency can be seen in the following Table:

Table 9.15 Technology Capacity to Manage Spatial Data and Information in West Lombok Regency

No	Technology readiness aspect	Availability	Notes
1	GIS Software	Available	GIS open source software is employed
2	Hardware to support spatial data and information management		
	Personal Computer (PC) for spatial analysis	Not available	
	Server	Not available	
	Special room for spatial data and information server	Not Available	
3	Internet subscriptions to support spatial data and information sharing activities	Available	Internet subscription with a bandwidth 1-2 Mbps
4	Geoportal	Not available	
5	Spatial data catalogue system	Available	Available in hardcopy format
6	Spatial data catalogue online system	Not Available	
7	Metadata storage with maps and digital database	Not available	
8	Metadata to compile spatial data catalogues	Not available	

The research questionnaire revealed that the use of technology pertaining to SDI in West Lombok Regency government is not adequate: as can be seen from the Table, most of the technological components are filled with ‘unavailable’ answers.

Some PCs have open source GIS software installed. But they have never been used for spatial analysis. The absence of a dedicated server for data and information storage leads them to be stored on a portable hard drive belonging to government staff, which creates a high risk of damage and data loss. The lack of a server is traced in this interview one of the senior management staff in BAPPEDA Lombok Barat:

> *"Actually, the existence of server in BAPPEDA Lombok Barat is available. The server was obtained from Ministry of Home Affairs’ in 2012. The server did not only function as the storage of official data and information but also served as the web server, application server and database server. However, the problem occurred due to lack of the official delivery invoice of the server from Ministry of Home Affairs to BAPPEDA Lombok Barat. Thus, BAPPEDA Lombok Barat decided to keep the server in the office but did not use it due to fear of misuse. To overcome [the problem of] data and information storage, so far [they are], kept in the PC and portable hard disks.”*

(BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

The interview explains that the main obstacle in supplying a server as one of the aspects of technological readiness is bureaucratic procedure between central and local government. A Further problem in bureaucratic procedure, which leads to the server not working, is the lack of the communication between institutional levels. Thus, again, leadership factor is a decisive factor in supporting the implementation of SDI.

As was explored in Section 9.4.2, supporting technologies for GIS data management purposes such as WebGIS and a geoportal are not available. In general, the technological aspects of SDI implementation in the government of West Lombok regency are not ready yet.

Organisation

Details of the institutional aspect of SDI assessment in the government of West Lombok Regency can be seen in the following Table:

Table 9.16 Organisation Capacity to Manage Spatial Data and Information in West Lombok Regency

No	Organisational readiness	Availability
1	A cross-agency coordination / steering committee for spatial data creation, management and utilisation	Available
2	A special GIS unit	Not available

The fieldwork questionnaire indicates that the institutional aspect of the West Lombok Regency SDI is partially ready: there is coordination between government sector services regarding spatial data management for spatial planning and development purposes. The coordination of spatial data management is conducted through The West Lombok regency spatial planning coordinating board, as an *ad hoc* team of spatial planning consists of BAPPEDA Lombok barat and other government sector services (BKPRD Lombok Barat). However, until now, the government of West Lombok Regency has not had a GIS unit to handle spatial data management. The absence of a specific GIS unit constraint was discussed in sections 9.4.2.

The fieldwork reveals that the leaders / heads of government institutions have begun to realize the importance of spatial data in supporting planning and development goals. Thus some the Regency government sector services, such as public works and agriculture and fisheries services, have changed their organisational units in order to manage spatial data and information.

There is great opportunity for inter-governmental spatial data sharing under West Lombok Regency authority. This can be shown by the experience of cooperation between BAPPEDA Lombok Barat and the Lombok Barat Land agency (BPN Lombok Barat).

At one time, BAPPEDA Lombok Barat required geo-referenced digital data related to an administrative boundaries dispute in West Lombok Regency. The BPN Lombok barat promptly provided the digital spatial data and information requested by BAPPEDA Lombok barat. Similarly, when the BPN Lombok barat required spatial information about land use planning, the BAPPEDA Lombok barat provided spatial data and information in digital format.

Even though spatial data and information exchange is still conducted conventionally using flash disks the willingness to exchanges spatial data between BAPPEDA Lombok barat and BPN Lombok barat is evidence that trans-horizontal communication between organisations in the government of West Lombok Regency already exists.

> *"The opportunity to conduct spatial data sharing amongst the Regency government agencies is a highly possible implementation. For example, in the past, BPN Lombok Barat asked for spatial data about spatial planning, we give it freely in the editable format [shapefile] without convoluted bureaucracy. Then the next day, BAPPEDA Lombok barat requested cadastral map, BPN gave it to us in editable format too. Even though data sharing transaction are still conducted manually through hard disk to flash disk, the point is, our communication amongst government institutions has run very well.*

(BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

Good communication between government institutions is assisted by having a clear legal basis. Thus, the synchronization of policy is urgent, and is discussed in the next section.

Policy

Details of the assessment of the policy aspect in West Lombok Regency can be seen in the following Table:

Table 9.17 Policy Support to Manage Spatial Data and Information in West Lombok Regency

No	Policy readiness	Availability	Notes
1	There is a strategic plan or roadmap for development of spatial data infrastructure	Not available	
2	Spatial data management follows the Indonesian national standards or technical specifications determined by the Ministry / agency	Available	
3	There are formal mechanisms for spatial data sharing between government institutions	Not available	
4	There is a regulatory mechanism for authorising spatial data use by the public	Not available	
5	There is a regulation related to spatial data use and management	Not available	
6	There is a Regent regulation concerning utilization and management of spatial data	Not available	

Financial support from the state, whether from local government budget (APBD) or Central government budget (APBN), required for spatial data sharing operationalization. The financial support for SDI operationalization in government agencies consists of data, software and hardware procurement, maintenance and internet subscription. Details of the financial allocations of SDI operationalization in West Lombok Regency can be seen in Table 9.18.

Table 9.18 State Budget Support to Manage Spatial Data and Information in West Lombok Regency

No	Activity	Budgeting system			
		Routine		incidental	
		APBD	APBN	APBD	APBN
1	Spatial data procurement	✓			
2	Software and hardware Procurement			✓	
3	Maintenance / updating spatial data	✓			
4	Metadata procurement (information about spatial data)			✓	
5	Spatial data sharing system Maintenance / development	✓			
6	Internet subscriptions for spatial data sharing activities	✓			

Based on information from the questionnaire conducted during fieldwork, assessment the policy aspect of SDI in the government of West Lombok Regency is assessed as not yet ready. The majority of policy aspects pertaining to spatial data sharing and exchange conditions, procedures and regulations, are not available.

Although the policy aspect is not ready yet, financial support by the Regency government for spatial data development is partly ready. The majority of the spatial data management related budget items are already available through sub-government programmes in the main government agenda regarding planning and development processes.

As a senior management staff member of BAPPEDA Lombok barat said:

> *"In fact, a special programme for spatial database management does not exist, but often the programme is involved in various planning or development programmes, such as urban regeneration programme. Therefore, there is always an alternative way according to financial support regarding spatial data development. But specifically, the construction of the database does not exist, or we can say that we provide spatial data development through an incidental state budget (APBD Insidentil)."*

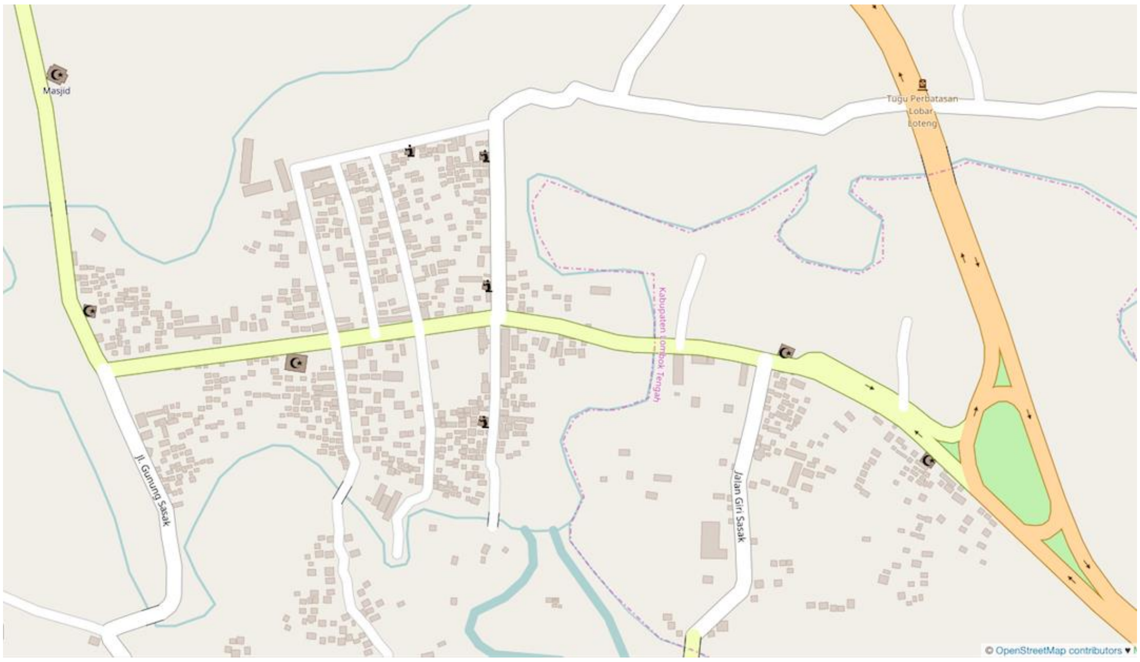
(BAPPEDA Lombok Barat Senior Management Staff; Interview at 10th March 2015)

In addition, West Lombok Regency has not issued regulations or the Regent decisions for the creation of a local spatial data network hub.

Overall, the regulation made by the Regency government has not explicitly guided the relationship between government agencies concerning spatial data exchange and sharing. Thus, regulations needs to be immediately prepared for guiding spatial data sharing towards spatially enabled government in support of the Indonesian NSDI.

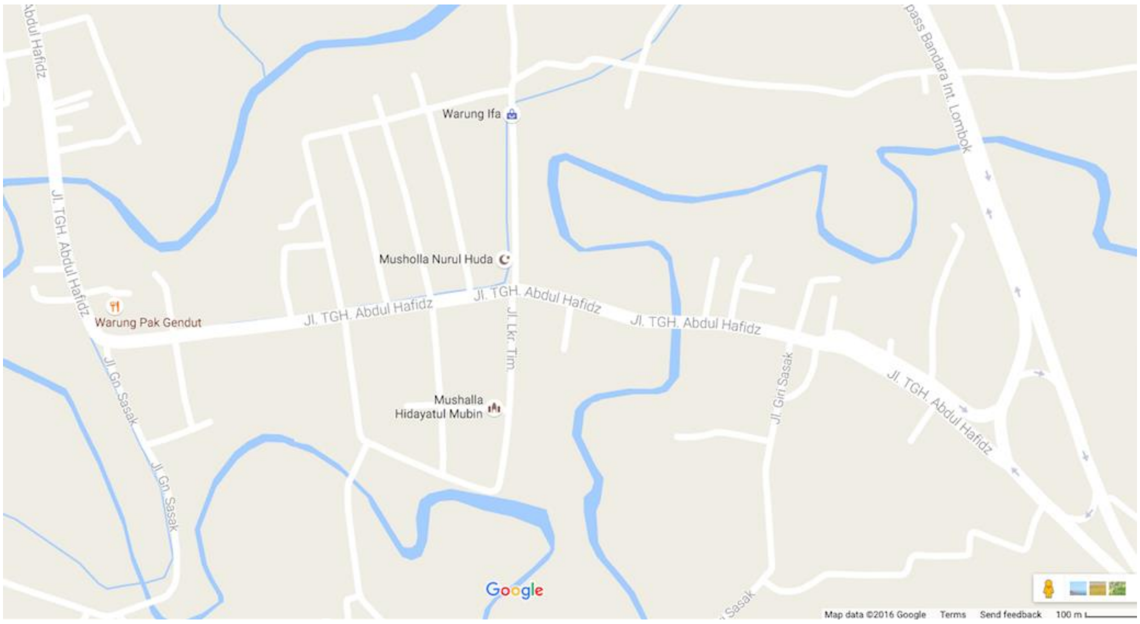
9.4.4 VGI performance in West Lombok Regency

Spatial database development by the VGI community in West Lombok Regency was initiated through the OSM platform in the period 2011 - 2012 as one of the selected ACCESS II Project regions described in Section 9.2.5. VGI community activities in West Lombok Regency have built spatial databases in several villages which can be seen from a comparison between spatial visualisation on the OSM platform and Google maps in the following figures.



Source: OSM, 2017

Figure 9.15 Spatial Database In A Kampung (Village) in West Lombok Regency Built By The OpenStreetMap Community



Source: Google Maps, 2017

Figure 9.16 Spatial Database In A Kampung (Village) in West Lombok Regency Built by Google Maps

Spatial information created by the OSM community contain higher numbers of digitized spatial objects and essential facilities and infrastructure (Figure 9.16) than the Google map which does not display any buildings (Figure 9.17). It is clear that public awareness of spatial database development makes a tangible contribution to urban management. This is in line with the ‘Community of practice’ theory (Wenger,1998) and VGI behaviour aspects (Coleman et.al., 2009).

Examination of the spatial databases created by the VGI community in West Lombok Regency, indicates that they provide reasonably reliable spatial information for basic planning and development analysis. However, the interactive community mapping activities by the OSM community are selective area-oriented projects which constraints spatial database development, consistency and updating.

9.5 Existing spatial data sharing between the Province of West Nusa Tenggara, Mataram Municipality and West Lombok Regency.

This study of spatial data sharing aims to support spatial planning processes in the three case studies by assessing the less developed regions at different administrative levels. The results reveals that spatial data sharing is absent or only very limited. This can be seen from spatial data dissemination flow in Figure 9.18.

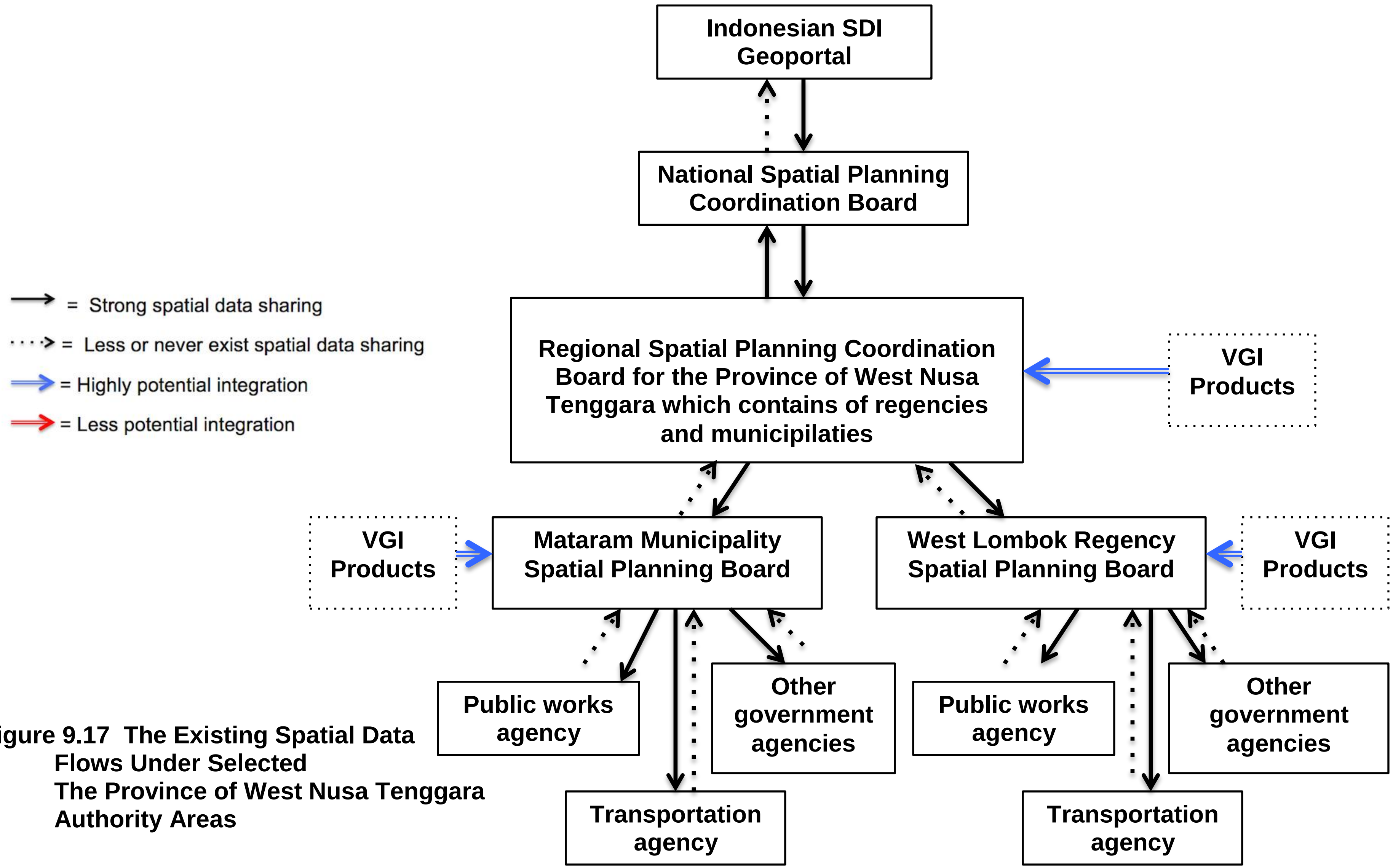


Figure 9.17 The Existing Spatial Data Flows Under Selected The Province of West Nusa Tenggara Authority Areas

Figure 9.18 describes the existing top-down work flow of spatial data dissemination in three government organisations: The Province of West Nusa Tenggara, Mataram Municipality and West Lombok Regency. Work process for spatial data acquisition, display and distribution are often officially defined in vertical structure relationships but carried out on a*d hoc* or project-related bases in horizontal organisations.

The lowest organisational level does not share data with upper levels due to lack of technical procedures and also due to lack of leadership. Spatial data and information sharing at province and local (Municipality and Regency) government levels is conducted in a top-down and across (vertically down and in both directions across) but not bottom-up.

Generally, the failure of SDI at the municipality and regency level can be explained by the theory of organisational maturity level regarding organisational change and information dissemination (Kok and Loenen, 2005) (See Chapter 2, section 2.4.3). According to this model, in relation to spatial data dissemination activities, Mataram Municipality and West Lombok Regency are positioned at Stage I. At this level, organisational behaviour can be described as conservative, self-seeking and less willing to transform into a different system. On the other hand, the Province of West Lombok Regency can be seen to be positioned at Stage IV. In this class, the organisation has a positive response and full support to contribute to the change process. In terms of the NSDI context, the stakeholders participating as NSDI custodians have worked with sharing and exchanging data for the public domain. On the other hand, in terms of VGI products, at Municipality and Regency levels have highly potential integration with official Municipality and Regency Goverments' spatial data.

The research investigations point to potential integration between official spatial data and spatial data developed by VGI community. VGI can help develop governance capabilities and leaders' awareness of the lack of government capabilities in human resources, technology and time as well as limited financial support to build spatial databases. Government leaders look for an alternative solution through requests for assistance/cooperation from international funders, in this case, the World Bank, AusAID and DAAD, cooperate with HOT as the international credible organisation to build spatial data through partipatory community involvenment, to provide and develop spatial data and information in GIS capacity building programmes for Municipality and Regency levels.

With community involvement, spatial data development is based on a participatory community through an open source spatial database platform and the quality control of spatial data products. HOT international through HOT Indonesia representation, has been able to convince Municipality and Regency government to put VGI on the planning and development agenda. The success community engagement in developing interactive mapping in the District of Dompu has given a positive impetus to the development of a spatial database development by a VGI community in West Nusa Tenggara Province. Overall, VGI outputs can be involved in official spatial data management when supported by the leadership of the government institution involved in the spatial data planning and development agenda.

9.6 Summary of Chapter

Spatial data management appraisals in areas of less developed regions are interesting to explore, because even though the assessment of general governance capabilities by the Indonesian Governance Index (IGI) classed these areas as ‘unsatisfactory’, they performed well on I-SRI assessment. In general, spatial plan enactment in this group of case studies is similar to the more developed regions, and some administrations have not ratified their spatial plans yet. This is mainly due to political compromise needing to be reached in the discussion of spatial plans, including changes to technical aspects and content of spatial plan maps.

Taken together, this chapter and the preceding chapter attempts to provide an answer to the fourth research question: “How is spatial data management performing at provincial and local government levels in supporting Indonesian NSDI?” SDI theories suggest that SDI readiness assessment in areas with less developed regions will present lack of SDI performance. However, the empirical case study findings reveal that this may not always be the case. Assessment based on the five aspects of SDI readiness spatial data development performance in areas with less developed regions are summarised as follows

- Data

Appraisal of the data aspect of SDI at three administrative levels produces variable results. In general, the province level is better prepared for spatial data and information sharing than municipality and regency levels. In technical aspects, the Province government has already provided digitalised, regular updating and maintenance of spatial data, whereas this is not the case for municipality and regency levels. The Province is well-prepared for spatial data production and provision because the central government gives strong assistance related to SDI, but central government support for municipality and regency levels is minimal or even non-existent.

The poor spatial data management performance at municipality and regency levels is related to the implementation of a decentralized bureaucratic system. Since decentralisation reform, the role of central government at municipality and regency level has been reduced. Decentralisation reform has meant that municipality and regency governments pay attention to the needs of the real local sector development, for instance, road and bridges or the procurement of agricultural equipment to support increased agricultural harvests, rather than concentrating on spatial data and information management.

- Human resources

Strong central government assistance for SDI implementation at the province level and less support at the municipality and regency levels also influences the human resources aspect of managing spatial data and information. The Province has strong staff capacity for managing spatial data and information while municipality and regency levels lack qualified personnel.

Like the more developed regions case study criteria, the less developed regions case study areas also only implementing the structural careers (*jabatan struktural*) of working units with no functional careers (*jabatan fungsional*) training for spatial data and information management. This creates a problem because promotion or changes in job specifications are not accompanied by the replacement of personnel whith geo-spatial knowledge. Furthermore, lack of specific positions with responsibility for spatial data and information management leads to the personnel in charge of managing spatial data and information multitasking jobs that are not related to the geo-spatial field, such as performing day-to-day administrative work.

- Technology

Like the two previous aspects, the Province has strong capacities in technology provision for spatial data and information management and sharing, but the municipality and regency levels have not.

- Organisation

The I-SRI assessment and this research show that most government institutions have GIS units for managing spatial data and information, but due to the high demand of administrative duties the unit has multitasked job desks and are not only concerned with data management. The Province has initiated some elements of preparation for SDI, but this the situation is not followed by the municipality and regency levels. Ultimately, all levels work under a centralised management approach which is oriented to a vertical organisation hierarchy and this impedes spatial data and information sharing amongst government working units.

- Policy

General observation in the case studies reveals that only the Province has a legal arrangement at the Executive level regarding spatial data and information sharing. However, there are no details of spatial data procedural guidelines for implementing the law. Therefore, spatial data and information sharing, from the lowest working units up to highest executive positions and *vice versa* in a particular government institution, is not in place in practice.

Five aspects of SDI appraisals reveal that only the province level gives good SDI performance while the situtaion is not followed by the municipality and regency levels. Generally, less developed regions are less organised to implement spatial data and information sharing for spatial planning practice.

This research has found that the significant issues for better spatial data management (in both more developed and less developed regions) are not only the five pillars of SDI (i.e. data, human resources, technology, organisation and policy), but also social interactions, political will, funding, assurance and reward, and leadership and legitimiation. These findings will be used as the basis outlining a system for integrated spatial data sharing between official spatial data and crowd-sourced geographic information.

The next Chapter presents a model spatial planning and SDI for creating policy synergy and spatial coherence at all levels in Indonesia.

CHAPTER 10

A SPATIAL FRAMEWORK AND A PROPOSAL FOR SDI AND VGI INTEGRATION

10.1 Introduction

SDI building takes a top-down approach. This situation prompts the supplier-buyer worldview, in which only official spatial data suppliers like National Mapping Agencies (NMAs) view data as their institutional assets, and see end users as buyers of a product (Diaz *et al.*, 2011, pp. 305). But, VGI has transformed the role of users from merely data users/consumers to active contributors and providers (Diaz et al., 2011, pp.305).

Budhathoki *et al*. (2008) argue that SDI and VGI are not independent elements but rather, are reciprocal phenomena. They believe that these phenomena can be brought into a system where the part of the client of SDI is re-conceptualised as a producer (creator and customer of spatial information) and VGI is integrated into SDI-related procedures. To upgrade spatial data utilisation in SDI, Omran and Etten (2007) recommend using an interpersonal organisational way to enhance spatial data sharing in SDI. In the case of an informal community model (pretty much as in VGI) there should be a re-consideration of the principles of spatial information sharing and exchange and as well as rights to information, people in associations should have more obligations in the production of accurate data. (Omran and Etten, 2007). This is an area that VGI is potentially reliable through the synergistic nature and ethos of a group based upon an inherent readiness to share information.

This chapter discusses the empirical findings in order to build an SDI and VGI integration framework, and proposes SDI and VGI integration approaches for spatial planning practices. In doing so, chapter will attempt to answer the fifth research question: “How can SDI and VGI be integrated to meet top-down and bottom-up developmental approaches?". The discussion starts by examining spatial data sharing issues from government and citizen perspectives.

10.2 Identification of SDI and VGI issues based on the empirical findings.

In terms of identifying of SDI and VGI issues in empirical case studies, following conducting interviews and legal document collections, the next research step were coding. The coding was conducted through interpreted keywords of interviews and document analysis to draw out the significance of the words related to the research topic, which are recognised as the respondents' thoughts, ideas or expressions, also substantial issues of official documents. These are then sorted out into thematic classifications that summarise and convey the content. The coded information was then investigated by utilising content analysis.

In content analysis, the examination moves from a broad viewpoint to a specific insight into the research topic. This diagnostic discovering might be cross referenced with finding from documents and interviews. Finally, findings and outcomes were produced on the basis of the content analysis. The ultimate coding activities of spatial data sharing issues at all SDI and VGI can be seen in the following matrix. An overview of procedure of coding activities from interviews and document analysis can be seen in Appendix F.

Table 10.1 The Selective Coding of Spatial Data Sharing Issues in the SDI and VGI Context

Spatial data sharing issues at Central Government Level	Spatial data sharing issues at Provincial Government Level	Spatial data sharing issues at Municipal/Regency Government Level	Spatial data sharing issues between VGI communities through OSM platform
Inconsistent Data	Inconsistent Data	Inconsistent Data	Standardised Data
Many staff able to conduct spatial data analysis but distribute it to other units that do not consider spatial data production/provision	Some staff able to operate spatial data	Lack of staff able to operate spatial data	Rely on community participation
Incompatible Technology	Incompatible Technology	Incompatible Technology	Open Source Technology
Still developing spatial data sharing policy	Only starting to develop spatial data sharing policy	Mostly not yet considering spatial data sharing policy	Open database lisence
Still developing coordination between central government organisations	Only starting to consider cooperation between sector agencies under province authority	Most organisations are considering sharing data between working units in each sector service	Obligation to share data
Difficult Communication	Difficult Communication	Difficult Communication	Relatively Easy Communication
Need political stability	Need political stability	Need political stability	Neutral posisition

Need routine budget allocation for spatial data operation	Need routine budget allocation for spatial data operation	Need routine budget allocation for spatial data operation	Support from international donations
Need data security guarantee and institutional good reputation recognition	Need data security guarantee and institutional good reputation recognition	Need data security guarantee and institutional good reputation recognition	Comfortable with produce & sharing data and need certificate qualification to be VGI administrator
Most leaders support spatial data sharing but still lack legitimacy	Some leaders support spatial data sharing but lack legitimacy	Few leaders support spatial data sharing and also lack legitimacy	Work based on organisational leader instruction. Some official organisations legitimate data built by OSM community by acknowledging it fulfils required government needs

Technological artefacts

Financial/Accounting

Leadership & Legitimacy

Social Interactionism

Institution affairs

Political will

Assurance & Rewards

As a guide through the material, at the beginning of the research, the researcher decided to adapt the five SDI pillars as key frames: that is, data, people/human resources, technology, policy and organisation. The analysis of the findings shows that potential SDI and VGI integration requires more than these five factors. Therefore, aftwerwards examines how the coding activity indicates possible integration between official data and crowd-sourced information.

In carrying out coding, the researcher first identified the main issues of the five SDI pillars (open coding). Other issues that were not involved in the five categories were placed in an independent class. In the next step, the researcher re-classified the codes (axial coding). Finally, all re-classed spatial data sharing issues were interpreted into seven new factors (selective coding): - **technological artefacts** (data and technology aspects); **social interactionism** (people/human resources aspect merged with a new factor, communication); **political will** (policy aspect); **organisation aspect** remains the same as the organisational SDI framework. Additional factors identified were **financial/accounting**; **assurance and reward**; **leadership and legitimacy**. These findings form the basis of a proposed alternative for enhancing democracy through SDI and VGI integration. This is outlined in the next section.

10.3 A proposed alternative framework for enhancing democracy through SDI and VGI integration

Enhancing democracy in spatial planning can be achieved through dialogue between the elite and the public. One way to bridge the gap in communication between these two perspectives is sharing official spatial data and crowd-sourced geographic information.

While technical issues in spatial data sharing are necessary factors for achieving interoperability of common data and information in spatial planning, relevant social, political, economic, institutional, assurance and leadership factors are also critical points for achieving spatial data sharing. Drawing on the issues facing SDI and VGI integration examined in the previous section, the researcher proposes enhancing a democratic process through spatial data sharing by creating the SPATIAL framework, *Social interactionism, Political will, Accounting, Technological Artefacts, Institutions, Assurance and Reward, also Leadership and Legitimacy* (See Figure 10.1).

		SDI	VGI	SDI and VGI integration
S	Social Interactionism	• Legal conformity • Attitudes • Ambitions	• Altruism • Community building • A personal investment • Pride of place • Collective knowledge	• Reciprocity • Create conditions for social learning and problem-solving capacity • Gain support of public for agency policies
P	Political Will	• Attainment of goals of formal policy • Representative democracy	• Provides local spatial knowledge	• Integration to spatial policy process • Deliberative democracy
A	Accounting	• State's budget to support SDI operations and maintenance	• No transaction costs for exchanging data and information	• Sharing costs
T	Technological Artefacts	• Data quality • Data interoperability • Data standardisation • The Internet penetration and access • Technology devices ubiquity	• Data quantity • Open source apps • Linkages to collective activities	• Data Quality & Quantity • Digital literacy • Data interoperability
I	Institutions	• Single authority • Top-down hierarchy • Central control	• Collaboration • Community empowerment	• Interdependent network clusters • Divide authority
A	Assurance & Rewards	• Government agency commitment to produce, provide and share data • Salary for staff	• Community commitment • Social reward	• Trust • Accountability
L	Leadership & Legitimacy	• Directive • Organisation controller • Planning and guiding organisational process	• Guiding interactions, providing opportunity • Ability to encourage community • Validate and monitor spatial data created by their community	• Generative • Mediator, process manager • Selecting agents and resources • Influencing governance atmosphere

Figure 10.1 The SPATIAL Framework

10.3.1 Social Interactionism

The value of social interactionism in government agencies involves government intentions to interact in reaching agreement on the trans-horizontal relationships between actors and trans-vertical relationships between structural units. It aims to achieve the organisation's goals to meet public services needs.

From citizen's perspective, the value of social interactionism is the interaction between individuals who are involved in as community members to participate and collectively meet a particular group or network's goal. In reality, individuals have different motivations for participating. Participation is quite often propelled by morals, for example, empathy, hatred, offense, or recognition (Haste, 2004). In terms of information and communication, individuals are not only acting as consumers, but are also involved as producers, since they have the instruments to be both.

The civil society is essential for democracy. The term 'civil society' regularly alludes to an intermediate associational domain between the state and the family. Civil society is populated by associations which are separate from the state, which self-governance, and are shaped intentionally by individuals to ensure and drive their interests or values (White, 2004).

A vital part of data and information sharing in civil society is the level of community interaction. Putnam (1994) suggests that a high level of community interaction, or social capital, is central to law-based administration. He characterizes social capital as 'components of social association, for example, trust, norms and network, that can enhance the effectiveness of society by encouraging coordinated activities' (Putnam, 1994, pp.167).

An alternative approach to the interactions between government and citizens for spatial data sharing is to examine issues of governance. The governance approach conveys brings some new issues to light. It incorporates reciprocity and trust, and stresses the significance of social capital and civil society organisations in legitimizing the public domain. Embracing the idea of governance implies relinquishing concentrations on the political elite in favour of an approach that crosses the state-society divide.

10.3.2 Political Will

Socio-political stability is significant to encourage spatial data sharing activity. The main component of spatial data sharing is the capacity to access data. With this in mind, discussing political will in the SPATIAL framework cannot be separated from the political regime.

A regime is constituted by the clear or verifiable guidelines that characterize who the influential political actors are and through what channels and with what assets they effectively look for political positions (Hyden and Court, 2002). The more regime management is attributed with authority, reciprocity, trust and accountability, the more it creates authenticity for the political framework.

A political element is involved in spatial data sharing amongst government agencies and integration between SDI and VGI activities; for instance, one group might be hesitant to enable another that debilitates its own grip on power, even though they have been asked to do so in the interest of implementing policies. In the cases examined, the political impact is reflected in issues like the willingness of government agencies to share data and information regarding public demands.

10.3.3 Accounting

Accounting in the SPATIAL framework considers financial expenditure on spatial data sharing. In the geospatial world, data can be dealt with as a commodity in the limited sense of procurement and trade. The prospect is that SDI and VGI integration will saving state budget regarding spatial data production, provision and access to policy makers and the public.

SDI and VGI integration will create efficiencies in spatial data and information production and provision. they have advanced just to the extent being focused on which spatial data that is accountable can be accessed and retrieved. What is not allowed to be "shared" or interaction is required, strategies, objectives, and value-added services that are the setting for the spatial data usage.

As yet, there is no report or research about the exact costs and benefits of efficient state budget regarding SDI and VGI integration. The only cost/benefit study of state budget implementation of SDI is from the International Workshop on Spatial Data Infrastructures Report on cost-benefit/return on investment by European Commision conducted in 2006. Examples from INSPIRE (Infrastructure for Spatial Information in Europe). According to the Report, the benefit to INSPIRE country members of spatial data sharing indicated that against a cost of €93-138 million ($122-182 million US) per annum on INSPIRE, the potential profit was €770-1,150 million ($1,013-1,514 million US) per annum (European Commission, 2006). The INSPIRE calculated that massive profits can be earned by a state, so we can imagine if SDI and VGI can be integrated, the expectedly more possible benefit can be achieved.

10.3.4 Technological Artefacts

The technological artefact is a substantial element in the value added by spatial data sharing. Technological artefacts involved in spatial data sharing include technical data format, metadata, data interoperability, accuracy, precision, and validity of updated spatial data. Technical devices for these and also GIS software and hardware will help to share data and information. In addition, the architecture of participation in Web 2.0 is crucial. Posting data online (Web 1.0), for instance, is not as significant as including elements of real-time interaction (Web 2.0). "Online networking" tends to be used as a general term, but each component needs to be recognised separately.

Currently, for particular issues, such as in spatial planning process, spatial data sharing has increased the flexibility of ways for citizens to participate politically. It has additionally being able to be have knowledge of the local geographical conditions. The adequacy of spatial data sharing is additionally dependent on the the ICT framework and the levels of availability and broadband coverage in a nation. The availability and affordability of IT, computer and social media gadgets can likewise influence who participates and improve procedures for responsibility and transparency.

10.3.5 Institutions

An institution serves as a forum that brings individuals together to achieve organisational goals, in which they are managed through hierarchical units/ structure. The institutional approach to spatial data sharing incorporates researchers concentrating on political organisational values.

The compelling use of data requires the dedication and association of all staff through an organisation. It needs to be supported by:

1. A departmental data and information administration system which analyzes data distribution and needs and considers the offices and any important abilities to meet these targets for which people and organisations will depend on data procurement;
2. Institutional stability, work force and the administrative structure of a department;
3. Decentralized and available data and information units.

Spatial data sharing predominantly relies on inter-agency/institutional connections. As such, any institution's agreement to be involved in inter-institutional relations is principally determined by the independent "substractions" of the outcomes; that is, each institution will attempt to coordinate in data and information production and provision.

10.3.6 Assurance and Rewards

The spatial data sharing in SDI and VGI integration implies that governments can engage civil society in spatial planning process by sharing and exchange the exisiting geographical condition with planning agenda in the future. Also a VGI community can convince the government that their data or information is valid and trusted so that it can be involved in implementing real democracy while at the same time upholding government standards in spatial governance. Ultimately, the government needs to guarantee citizens' safety and ensure that they will not be in danger if they take part.

The research fieldwork indicates that, in the current system, the use of low quality data has no significant implications for either producers or users of spatial data. For example, low integrity spatial data does not affect the budget or the performance report of the Ministry or agency concerned, and the qulity of spatial data, does not affects key performance indicators. Therefore, to improve spatial data integration, incentive/rewards for the production and provision of reliable spatial data may help to change the individual or organisational behaviour towards transparency regarding spatial data sharing.

10.3.7 Leadership and Legitimacy

Based on the fieldwork findings, spatial data and information sharing is connected to the primary requirement for a principal leader of engagement, who has adequate inspiration, impact, and assets to see through a spatial data sharing activity while not distancing or undermining others. Nonetheless, a critical point here is that we can never basically bifurcate the "powerful" and "powerless" in terms of strength—there are various partners with separate, equal and frequently clashing interests.

Spatial data sharing amongst government agencies and integration with VGI is indispensable so that a leader need to ensure that these principal issues with their effects are understood and acknowledged by staff through all the institutions. This evaluation of the assets of the organsiation should reflect the staff’s power, abilities and assistance, and make educated choices.

Some technologies for spatial data sharing will need to be updated The leader will need to look at the best strategy to guarantee viable usage of such technologies and create the essential conditions for the acceptance of this approach. Ultimately, a leader can minimize departmental dependence on technology from outside organisations and assume liability for the acquisition of essential components of the technology, for example, GIS expert recruitment.

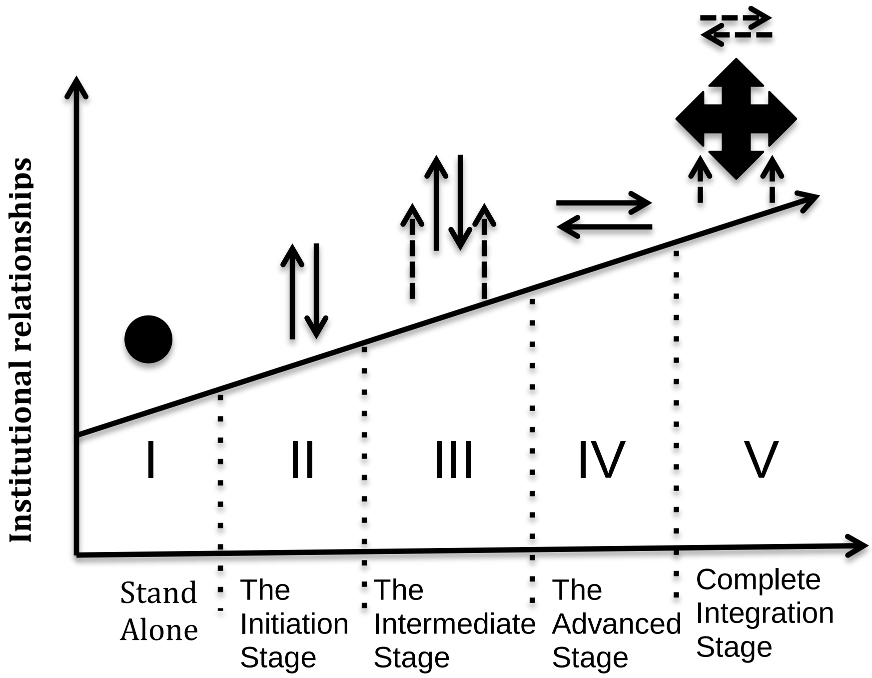
In addition, legitimacy in sharing spatial data is needed as a form of pressure for organisations to conduct dissemination and exchange of spatial data. As Oliver (1990) argues, legitimacy becomes one of the significant factors for an organisation to be willing to share data when this obligation is present their agreement with the overarching standards, rules, convictions

10.4 A proposed model of organisational willingness and participation for spatial data sharing.

Spatial data sharing has a substantial role for willingness to share and exchange spatial data amongst government agencies and to allow the integration with crowd-sourced geographic information.

As explained in Chapter 2, organisational willingness to share and exchange data can be described in terms of organisational maturity level (Kok and Loenen, 2005). Kok and Loenen (2005) divide the levels of maturity in data sharing between governmental organisations into four stages: stand alone; exchange and standardisation on a technical level; intermediary; and network (See Figure 2.10).

In this section, the researcher proposes a model of organisational willingness to share spatial data and integrate SDI and VGI adapted from Kok and Loenen's (2005). The proposed model suggests five stages for integrating SDI and VGI. Stage 1, is identified as ‘stand-alone’ behaviour. Stage 2 initiates spatial data sharing between the trans-vertical units in one government organisation; at Stage 3 there has been collaboration between the official institution and external official spatial data providers. In Stage 4, there is trans-horizontal spatial data sharing and exchange amongst government agencies. The final Stage (5) shows fully coordinated official spatial data and VGI (See Figure 10.2).



Source: Adapted from Kok and Loenen (2005)

Figure 10.2 The Willingness of an Organisation to Share Spatial Data in the SDI and VGI Integration Context

10.4.1 Stage I: Stand Alone

At this Stage, the organisation creating spatial data tends not to participate in the sharing and exchange of data and information and still considers data and information as power. On the other words, the role of the institution would be reduced as data and information are disseminated. In general, these institutions are conservative and only pursue their own organisational goals.

10.4.2 Stage II: The SDI Initiation

At this Stage, working units under an organisation perform some data sharing, but it is carried out in the context of inter-unit or departmental area within a government agency. Thus, the data and information needed for analysis can be used directly by a particular bureaucracy with a permit from the head of the working unit. It can be carried out by downloading or uploading processed data and information to the portal.

10.4.3 Stage III: Intermediate SDI

This stage is a continuation of the initiation stage and involves spatial data and information sharing carried out amongst working units under a government agency with the incorporation of spatial data products from outside the official system.

The situation at this stage is characterised by a government organisation that serves as custodian responsible for the provision, management and distribution of certain spatial data and which follows recognised NSDI standards for specific spatial data themes. As a custodian, a government organisation has the authority to undertake spatial data collaboration with other outside official institutions, as long as they meet national standards and ensure valid and accuracy data.

10.4.4 Stage IV: Advanced SDI

At this stage, the government has established geographically referenced standardisation so that spatial data sharing can be carried out in cooperative trans-vertical and trans-horizontal governmental relationships. The characteristic of the organisation in this stage is good cooperation between vertical and horizontal organisational structures. They are willing to engage in cooperation and collaboration in order to achieve nation goals.

10.4.5 Stage V: Complete Integration

This stage is the highest level of spatial data sharing. In this stage, the integration of spatial data between official spatial data and crowd-sourced geographic information is well-coordinated. The technical standardisation of spatial data and information is applied to government agencies and interoperable with existing systems of external government organisations.

Overall, this fifth level is a condition where there has been broad support from government and citizens to be engaged in a democratic process. VGI is produced by a proactive community cooperating and coordinating with government to find innovative solutions for social problems.

10.5 A proposed model of the community participation stepped in government agency agendas

In a move towards a democratic environment, the government introduces data sharing between government and community using a specific spatial case to illustrate that the participation of both parties is crucial. Therefore, the next section discusses how proposed community participation can be involved in the government's agenda.

According to governance perspective, potential spatial data and information integration between official spatial data and crowd-sourced geographic information in the spatial planning context is determined by active communication between government and citizens. To determine the activity level of communication by both parties, the model draws on Arnstein's (1969) participation ladder, together with Haklay's (2013) levels of participation and engagement in citizen science projects relevant to spatial data sharing.

The researcher proposes a stepped model of community participation the government's agenda through spatial data and information sharing between official spatial data and crowd-sourced geographic information. Purpose of proposing this model is to identify the levels of public participation and government participation in creating collaboration, cooperation and coordination in the spatial planning by involving spatial data sharing (See Figure 10.3).

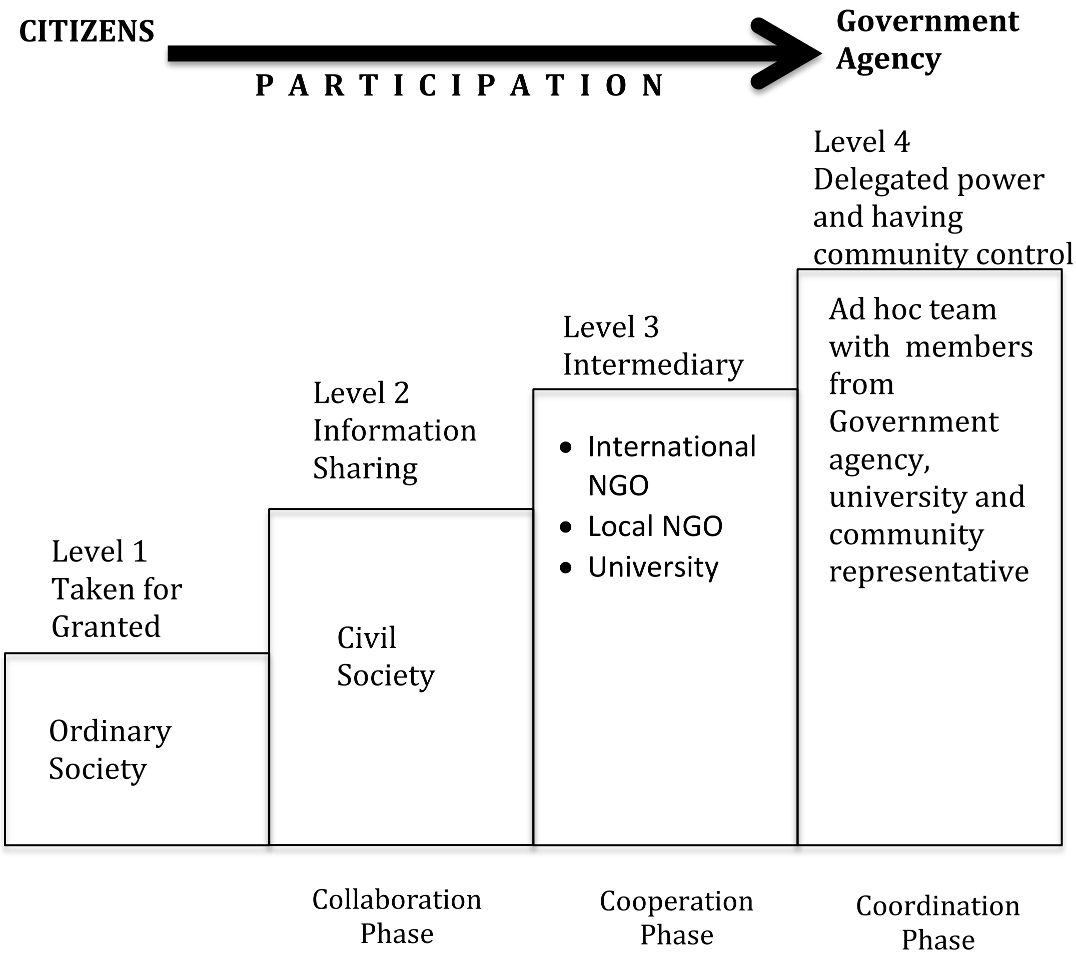


Figure 10.3 A Stepped Model for Community Participation in Government Agency Agendas

10.5.1 Level 1: Taken for granted

Citizen who live in an area which involved in a government planning agenda have passive attitudes. They take for granted that planning activities are developed and implemented by the government. Likewise, from the government's perspective, the community does not need to be involved in the development agenda. At this stage, political communication between community and government in terms of planning and development agenda has not been achieved.

10.5 2 Level 2: Information Sharing

People are concerned about the area where they live and provide current information about conditions in their local region. information can be delivered through *Musrenbang* (public hearings) or submitted online, including spatial data sharing in a user-friendly platform between the public and the government. The government tends to accept public input for improving the planning agenda. At this stage, collaboration between citizens and government has begun.

In terms of spatial data sharing, citizens as sensors have volunteered to be local mapping contributors by interpreting spatial objects on a user-friendly WebGIS internet platform. It aims to inform other communities and reports current condition as input in spatial policy making.

10.5.3 Level 3: Intermediary

This stage bridges the gap between public demand for improving their living environments and the government agenda, which has been drawn up for planning and development implementation. In a development activity, political communication between a government agency and the public often reaches a deadlock. Thus, facilitating communication between the two parties needs an intermediary actor has been selected based on personal or community organisation experience with a good reputation trusted by the both sides. Frequently, the intermediary actors in planning activities are international or local NGOs and universities. At this stage, participation between citizens and government has moved from collaboration to cooperation.

In terms of spatial data sharing, high community interest in spatial data will need a VGI organiser to control spatial data quality and reliability. Sometimes, the task of the VGI organiser is as a substitute for local mapping contributors to the continuous updating of spatial data.

10.5.4 Level 4: Delegated power and community control

This stage is the ultimate step in creating coordination between government and the public. The members of the *ad hoc* team are respresentatives from government, universities and community organisations and are generally established in planning and development practice. This *ad hoc* team works to formulate spatial policy and determine spatial planning programme priorities in real development projects. In terms of spatial data sharing context, the VGI organiser and SDI operators join the *ad hoc* team to manage spatial data sharing transactions and work to ensure reliable quality and quantity of official spatial data.

Overall, the proposed spatial data integration model between official spatial data and crowd-sourced geographic information in a non-technical organisation is strongly influenced by willingness to share and exchange data. It requires active participation of government and citizens to collaborate, cooperate and coordinate in the Indonesian NSDI. In the next section, the researcher proposes a soci-technical model for SDI and VGI integration in spatial planning generally and specifically for Indonesia.

10.6 A proposed model of a socio-technical SDI and VGI integration for spatial planning

Currently, citizens engaging in creating and sharing spatial data by placing their territorial observations on public web mapping application programming interfaces (APIs), such as Google Maps, Wiki Mapia, OSM and Microsoft's Virtual Earth (Rouse *et al*, 2007; Goodchild 2007; Tulloch, 2007) are called VGI communities. Practically, VGI makes up-to-date spatial data contributions to social life. However, this technique does not replace the need for spatial data coordination. Therefore, accommodating VGI in the Indonesian NSDI framework is a possible future scenario for spatial data being much more widely available online from (global) private sector actors.

Budhathoki *et al's* (2008) ideas of empowering all stakeholders in spatial data sharing and exchange have been drawn on for a re-conceptualized model for spatial data co-production concept (see Chapter 3). With this in mind, the researcher inspired to adapt Budhatoki's spatial data co-production concept to be detailed re-conceptualised NSDI and VGI integration model for Indonesian spatial planning system (See Figure 10.4).

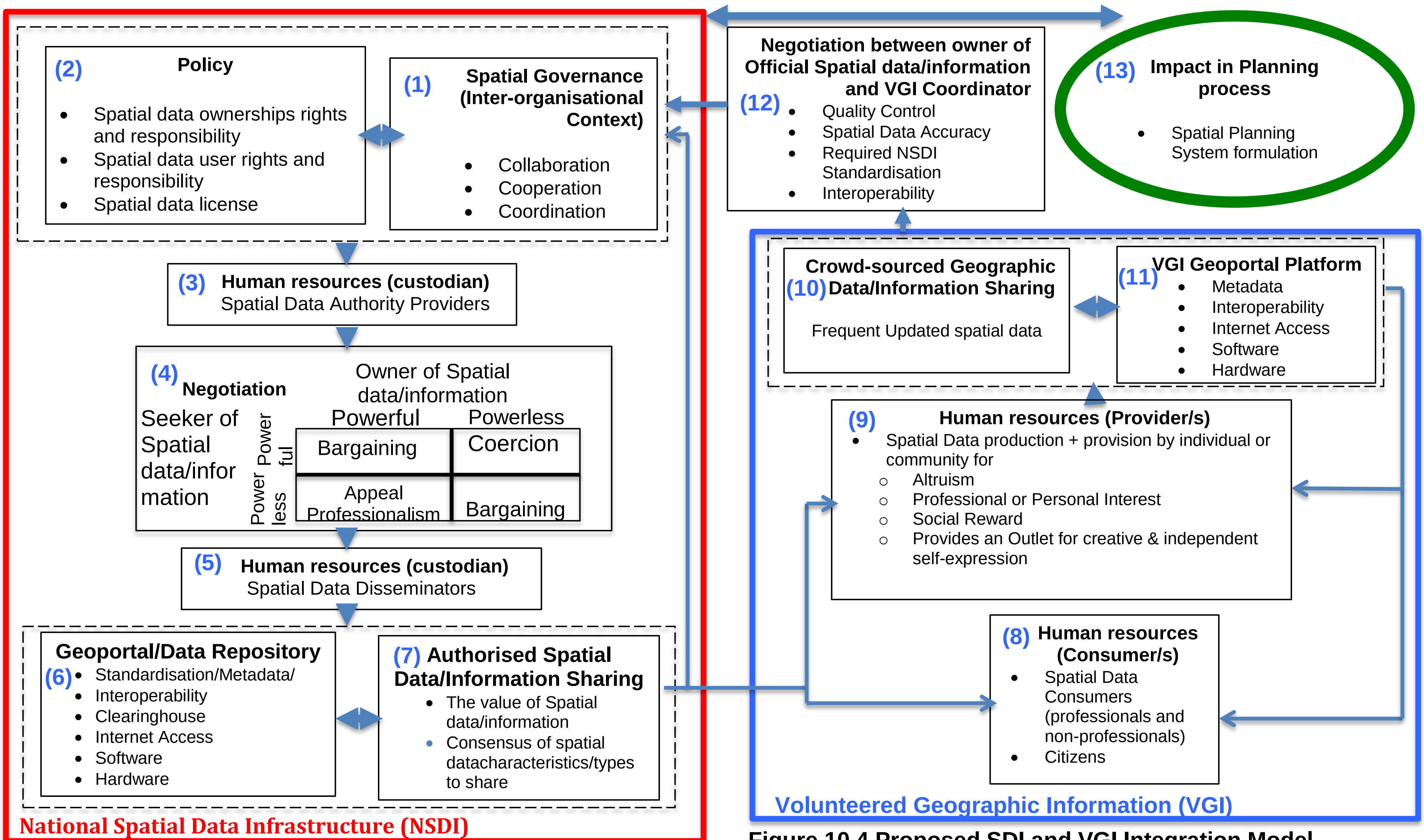


Figure 10.4 Proposed SDI and VGI Integration Model

Figure 10.4 can be explained as follows:

1) To achieve consensus over spatial data/information sharing in the Indonesian NSDI context, similar visions and goals are prerequisites for any participation by national, provincial and local (Municipal and Regency) government organisations. The key factors for access and to sharing spatial data/information in each government institution are collaboration, cooperation and coordination in implementing the inter-organisational tasks. As these are authorised organisations, this component has a relevant link with policy and spatial planning processes.

2) When it comes to examine official spatial data sharing, the issue of policy will follow. A specific policy issues will be focused on spatial data ownership rights and responsibilities, spatial data user rights and responsibilities and spatial data license.

3) In the spatial data/information sharing context, custodianship has a crucial role. In this model, there are two custodianship groups: spatial data providers and spatial data disseminators. The reason to separate this group is to minimise the workload of spatial data custodianship.

4) In the Negotiation box of the diagram, there are two actors with crucial relationships with spatial data/information sharing: the owner of the data/information, and the seeker of data/information. Adapting from Obermeyer and Pinto (2008) idea, spatial data sharing can occur with intergovernmental information sharing alliances.

   The Obermeyer and Pinto's model introduces bargaining, coercion and appeals to professionalism. In bargaining, organisations have an assortment of assets available to them. In a few occasions, data/information swaps might be conceivable. A few organisations might have the financial assets to buy data/information from different organisations or to give some other monetary consideration.

Inter-governmental institutions alliances can occur through coercion. It means sharing value can be implemented when the highest level of government with its legitimates to give pressure to lower governmet levels to share data or information that allowed to acces by public. Appeal to professionalism for particular cases represents an interest to some degree altruistic/philanthropic respectable values. In different occasions, such appeals may reflect earnest self-interest for sharing on the professional way.

5) After an agreement amongst institutions has been reached, data/information will be shared by disseminators by inputting spatial data/information to a geoportal.

6) Spatial data/information is the central point of the NSDI. Two factors prominent to achieve spatial data/information sharing are the value of spatial data/information in governmental institutions and consensus from a government regarding official spatial data characteristics/types that allowed to be shared.

7) SDI cannot be separated from information infrastructure, thus, a geoportal/data repository is a crucial component in terms of spatial data uploading by the custodian authority and spatial data downloading by the users. From the technological perspective, a geoportal/data repository has the key elements of standardisation/metadata/general pattern, interoperability, clearinghouse, internet access, software and hardware. The role of a geoportal as “communication media’” is to link spatial data disseminator with spatial data users.

8) The official spatial data will be used by data and information users. The spatial data/information users can be divided into consumer and provider

groups. The spatial data consumers only using official spatial data for their interest without intention to contribute for reproducing data for the public. In other words, this community is involved as passive VGI group.

9) Some citizen communities provide crowd-sourced spatial data/information out of altruistic, professional or personal interest, or for social reward; in other words, providing data is an outlet for creative and independent self-expression. This community is involved as active VGI group.

10) Crowd-sourced spatial data/information created by VGI communities is beneficial because they provide spatial local knowledge. In practice, they update the data more frequently than the government, due to a large number of members and the use of user-friendly devices to produce and share spatial data/information.

11) Like NSDI, spatial data/information created by VGI communities can be stored in a VGI geoportal platform. Several VGI geoportal platforms have been recognised internationally including OSM, WIKImap, Google Maps, Microsoft Virtual Earth.

12) VGI communities have helped the government with practical spatial data/information. This can be negotiated with government by quality control, accuracy, required NSDI standardisation and interoperability checks upon VGI spatial data/information outputs to be accepted in NSDI system.

13) The findings of this research relate to the impact of data sharing between government and citizen will create data and information transparency as the central in enhancing democracy environment in spatial planning process.

10.7 Summary of Chapter

Budhathoki *et al*. (2008) state that SDI and VGI are not independent elements, but rather, are reciprocal phenomena. They argue that these phenomena can be brought into separate systems in which the part of the client of SDI is re-conceptualised as the producer (both creator and customer of spatial information) and VGI is integrated into the SDI-related procedures.

This research identified seven factors that are important in the integration of SDI and VGI: viz. social interactionism, political will, technological artefacts, organisation or institution, financial issues or accounting, assurance and reward, and leadership and legitimacy. These findings were used to propose enhancing democracy through an SDI and VGI integration approach.

However, technical matters of spatial data sharing are necessary factors for interoperability to enable common data and information in spatial planning. Relevant social, political, economic, institutional, assurance and leadership factors are critical points for the achievement of spatial data sharing. Within this consideration in mind, the researcher proposes enhancing democratic process in spatial data sharing by introducing the SPATIAL framework - *Social Interactionism, Political Will, Accounting, Technological Artefacts, Institution, Assurance and Reward, also Leadership and Legitimacy*

Through exploring SDI and VGI issues identified in the empirical studies and examining the alternative proposal for SDI and VGI integration framework and models. The discussion of potential SDI and VGI integration has attempted to answer the fifth research question: “How can SDI and VGI be integrated to meet top-down and bottom-up developmental approaches?”

In addition, this chapter also provides the alternative SDI and VGI integration approaches to drive answering the last research question that is summarised in the last chapter.

CHAPTER 11

CONCLUSION: INTEGRATING SDI AND VGI IN INDONESIAN SPATIAL PLANNING

11.1 Introduction

The thesis began with a discussion of the data revolution from a restricted authority access regulations to the open data era, and specifically the use of spatial data in the planning process. The introductory chapter gave an overview illustrating the need for spatial data use by government to achieve successful planning programmes, and the involvement of crowd-sourced geographic information (VGI) under government management of informing, counselling, and coordinating the planning and development agenda.

The next three chapters explored the theoretical groundwork, conceptual framework and methodologies for understanding the potential of SDI and VGI integration, and the following five chapters highlighted the empirical research investigations of operationalising spatial data and information sharing in order to examine the concepts, approaches and models of SDI and VGI integration for enhancing democracy in spatial planning practices.

In this concluding chapter, the researcher summarizes the findings about current national spatial data management performance in Indonesia; key findings about local SDI and VGI practices; explores how SDI and VGI integration can enhance democracy in spatial planning; and presents the conclusion and suggestion for further research.

11.2 National spatial data management performance in Indonesia

In order to understand current spatial data management performance in Indonesia, the researcher analysed the findings of spatial data development and dissemination, particularly in relation to the central Indonesian government, and found that spatial data sharing performance between Ministries and government agency is poor.

The low performance is mainly due to lack of coordination between Ministries / central government agency, and because the roles and responsibilities of data custodians are unclear. In addition, there is little trust between Ministries / central government agency and this leads to complex data transactions which inhibit the dissemination of data and limit optimal data use. Lastly, spatial data and information sharing in Indonesian government organisations are conducted in convulated bureaucracy and disregard trans-vertical and trans-horizontal data and information exchange.

The main issues related to spatial data management at central government level can be tied to the five SDI pillars (data, human resources, technology, policy, organisation). These aspects of spatial data management performance in Indonesian NSDI can be summarised as follows:

a. Data

- Spatial data accuracy is low

Spatial data is less accurate in reflecting real conditions. On the producer side, it is caused by the weakness of the spatial data collection methods and the low quality of spatial data collection activities. In some cases, the spatial data collected cannot even be used or can only be used on a limited basis. Mechanisms to ensure the accuracy of the data are not present or do not operate optimally.

- Data redundancy

Spatial data for a single theme is collected by more than one Ministry or agency, or by different units under the auspices of one Ministry or agency. Data redundancy is caused by several factors, including the lack of detailed information about the overall development of existing indicators (and information about the data for these indicators), in addition to the differences in policies and regulations that apply to each Ministry/agency. Repetition or overlapping activities are also ongoing in the preparation or compilation of spatial data for development indicators. Redundancy leads to resource waste. But, in fact, spatial data collection can be coordinated and the data/indicators produced can be used by more than one unit or by different Ministry/agencies.

- Intermittent spatial data updating

In some Ministries/agencies, the most recent spatial data does not become included the main programmes. This is because updating spatial data is not organised to be continuous, periodic or automatic to trace change over a period. The problem of updating spatial data is also caused by late delivery of the spatial data.

- Data only shared at small cartographic scales

Spatial data sharing in the SDI context is normally disseminated at small cartographic scales (1:1,000,000 and 1:250,000).

b. Human resources

- There is no specific functional career designating a spatial data management unit

Examining the civil service bureaucratic system reveals that most the reforms to Indonesian government institutions have only implemented structural positions (*jabatan struktural*) for working units in the system with no functional careers (*jabatan fungsional*) for spatial data and information officer and manager. This contributes to the problem of lack of spatial data and information management performance because promotion of staff or change to positions and responsibilities are not accompanied by the replacement of personnel who have geospatial knowledge.

- The staff who are capable of managing spatial data have multi-governmental job desks

There is no specific GIS unit to manage spatial data and information, and the staff who are capable of managing spatial data are required to carry out multiple job desks, such as day-to-day administration.

c. Technology

- Spatial data cannot be accessed or access is limited

Spatial data development in the Ministries and government agencies that are financed by public funds cannot be accessed by the spatial data users. In some cases, spatial data can be accessed, but on uneditable format, for example, spatial data or information can be seen only in JPEG format on the website of the Ministry/agency.

- Time-consuming and wasteful of resources

An outdated of technology still exists in some Ministries. As a result of this issue, it can take a long time to gain access to data and the resources required for obtaining data from the Ministries and government agencies are relatively large memory. In addition, the inconsistency of data requires extra resources to clarify or harmonize spatial data consistency.

d. Policy

- Lack of clarity in the definition of a custodian

A detailed definition of a custodian, specifically related to the custody of the data generated from reprocessing or from compiling data, has not been yet set out. The regulation has not identified the party who will become the custodian when the data is generated by the Ministry / other government institutions, and then reprocessed and compiled.

e. Organisation

- LIttle coordination between spatial data users under Ministries / agencies

Internal coordination processes for spatial data use in some Ministries/agencies are not good enough. For example, spatial data users in Ministries / agencies request data from external producers when the same data can be collected from, or is already available in the Data and Information Center (PUSDATIN) or in a unit of their own Ministry / agency where users / requesters register the data.

- Unclear roles for data publication and dissemination

Data publication and dissemination is not regulated in a detailed, integrated and consistent way. According to the regulations, data, including spatial data should be officially published before it is made available for use. This sequence is to ensure data consistency and proper functioning under one-way data transactions. In institutional processes, data is only published after being authorized, verified and authenticated by PUSDATIN.

- There is no incentive/reward for institutions to integrate spatial data

As already mentioned, the use of poor quality data has no significant implications for either producers or users of spatial data. Spatial data with low integrity, for example, does not affect the budget or the performance report of the Ministry or agency concerned. Spatial data is not an element that affects Key Performance

Indicators. Therefore, there is no incentive/reward for spatial data producers or data users to change the behaviour of each and collectively improve spatial data integration.

In general, the condition of spatial data management performance in Indonesia, particularly at the level of Ministries and state agencies is still experiencing problems.

11.3 The key findings of SDI practices in sub-national Indonesian government agencies

This section examines the appraisals derived from the empirical investigations to give an overview of the key findings about sub-national SDI practices in Indonesia. In terms of NSDI development, some sub-national regions in Indonesia have emphasised spatial data and information sharing initiatives in the planning context. At central government level, it is popular with ‘One Map Policy’ agenda. At province level, the ‘East Java Spatial Information System (SITR)’ and ‘one data West Nusa Tenggara policy’. At the local level (Municipality or Regency), the Surabaya Integrated Planning Systems (SIPS) was studied.

These findings are discussed under the headings of the five SDI pillars

- Data

Spatial data sharing at the province and local (Municipality and Regency) SDI level is normally published for the public as uneditable data, such as JPEG. Metadata is not created and in addition, spatial information is not consistently upgraded.

- Human resources

Generally, the human resource capacity is a more unintentional process and government mapping organisations have encountered being ‘down sized’, e.g. staff numbers are being reduced.

- Technology

Technological performance in the three case studies reveals performances at different levels. Provinces and municipalities have strong technological capacities for SDI but for the regency levels are weak in this regard because the regency level in geographically far away and so can't get technology devices to support spatial data sharing.

- Organisation

Local SDI in Indonesia have a predominantly top-down approach that affect long bureacucracy approval for spatial data and information publishing, sharing and exchange. In addition, spatial data sharing between governments is constrained by institutional variables, such as the legal system, hierarchical society and administrative structure.

- Policy

General observation from the case studies reveals that only more developed regions have a legal arrangement in the Executive position regarding spatial data and information sharing. However, the legal arrangement is not backed up by guidelines for spatial data sharing procedures. Therefore, there is no spatial data and information sharing from the lowest working units to highest executive positions and *vice versa* in a particular government institution.

Additional elements that influence spatial data and information sharing include the way that the development of SDI at the sub-national level is hindered by the complexity of upper organisation bureaucracy. This includes socio-political instability, funding barriers, various data standards, leader characteristics and organisational priorities.

Ultimately, the integration of local spatial data infrastructures with upper levels (Regency and Municipality to Province) is by all accounts confounded, while it easier for local SDIs to cooperate with VGI. As local SDI manage more frequently focuses on their authority areas that in most cases have small areas, local governments in less developed regions with limited capability and capacity in spatial data management can interact intensively and directly with their citizens to be involved in local government agendas for planning, e.g. spatial data and information sharing between existing local geographical conditions from citizens and spatial planning scenarios from government. These local SDIs are likely to have better quality spatial information by cooperating with VGI.

11.4 The key findings of VGI practices in Indonesia from the empirical investigation

VGI practices in Indonesia are predominantly organised by recognised international VGIs, in this case is Openstreetmap (OSM). OSM activities are performed in annual projects and initially digitized spatial data on buildings, roads, bridges and other infrastructure spatial objects in urban and rural areas for supporting government activities in disaster management. Assessment activities which were initiated by HOT Indonesia aimed to build the geodatabase for disaster management purposes which has created effective and efficient central government performance. Thus the Indonesian OSM projects remain continues.

Since 2012, the Indonesian OSM has cooperated with the Indonesian National Disaster Management Agency, *Badan Nasional Penanggulangan Bencana* (BNPB) because BNPB lacks spatial data management to identify and quantify the impact of disaster events.

Based on the exploration of VGI practices in Indonesia for this research, some key findings can be determined.

First, as the Indonesian landscape comprises both extensive rural areas and sprawling urban areas, there are distinctive strategies to collect spatial data and information in each type of geographic area. For rural areas, HOT Indonesia, Indonesian OSM management, started to collect information by cooperating with local governments (i.e Local Disaster Board agencies and Local Planning Board agencies) and civil society organisations (i.e. Scouts (*Pramuka*), local Red Cross (PMI), local youth organisations). Using OpenSteetMap, HOT started its work with local governments and local civic organisations by holding workshops to collect spatial data and information. There was a different strategy for urban areas. HOT Indonesia encouraged college or university students to spend significant time in GIS giving training to students about mapping on the OSM platform.

Secondly, there are five main stakeholders creating successful VGI activities in Indonesia: International funders, VGI organisers, local government, local organisation partners and local mapping contributors. The international funders have a critical part in persuading government to allow access to (open) data, guaranteeing their active backing of the undertaking, and organising and influencing the performance of all relevant partners, including VGI organisers. The generation of spatial data by VGI communities is ordinarily encouraged by civil society and VGI organisers. These organisers regularly have extensive involvement in the configuration and creation of VGI. During VGI activities, independent VGI organisers usualy work with local organisation partners for a limited period, helping them to make volunteered geographic data and then leaving. Local government has responsibility for guaranteeing support for the mapping procedure, encouraging local inhabitants to take part and enhancing financing. Local government advocacy of VGI procedures and the cooperation of local authorities with VGI organisers, local organisation partners, and local community mappers are vital to secure the ongoing achievement and effect of VGI activities.

Thirdly, in the OSM collaborative model, spatial data was validated by an OSM community itself and concerns about data quality could be raised by OSM members. Subsequently, an acceptance technique has been created, despite the fact that the standard is not formalized as in a conventional SDI. Facing the digital mapping problem, building and maintaining geodatabase-based community participation can be understood as ‘communities of practice’ (Wenger, 1998). The community is aware that external factors can benefit from the community and is able to establish the identity of the region. In other words, public awareness for updating spatial data voluntarily through digital mapping work automatically when a community is able to show how mapping spatial objects increases learning and contributes to forming community identity.

Fourth, spatial data sharing in the VGI context in Indonesia normally disseminates spatial data at large cartographic scales (1:1,000; 1:500). In addition, metadata is automatically recorded when a VGI contributor registers on the OSM platform for the first time. However, ultimately, the systematic upgrading of spatial data will depend on the procedures for implementing digital mapping projects.

Fifth, spatial database development was undertaken voluntarily by the District of Dompu community which had been given attention by the government of Dompu Regency. The results of the interactive mapping conducted by the VGI community produced excellent quality data and provided benefits to support the Dompu Regency government's agenda. Similarly, evidence of spatial data quality and accuracy created by the OpenStreetMap community is trusted by BNPB and BPN institutions at the central level that now use OSM data. The success story of community engagement in developing interactive mapping already shows the opportunities for spatial data integration between official spatial data and crowd-sourced geographic information (VGI).

11.5 Theoretical reflections on the relations between spatial planning, spatial data sharing and democracy

Spatial planning has a primary function as guidance for national life at all levels (national and sub-national levels). The kinds of spatial planning policy and programmes enacted by the different levels of government depend on the tier of government. The Indonesian spatial planning process was carried out by utilising and taking into account the resources, information, science and technology and attention to the development of a global world with the aim of improving people's welfare.

In spatial planning processes, different aspects of society, such as social, economic, historical and cultural can be understood through maps or spatial visualisations, because those media can translate abstract phenomena into discourse and images (Dühr, 2007; Stephenson, 2010). Furthermore, spatial visualisation may assist in mediating planning debates (Healey, 1997), setting planning agendas (Forester, 1982) and incorporating various planning stakeholder viewpoints (Robbins, 1997). Spatial data and information have a role to play spatial governance by providing thematic spatial data and information and analysis at all authority scales (Vincent, 2008). Furthermore, today, spatial data and information are a prerequisite for any participation in planning consensus (Campbell and Masser, 1995).

Since geospatial data are developed in a fragmented way, inadequate accessibility and interoperability of the data occurred. Fragmented geospatial data development has created many issues, such as technical problems (i.e. different geo-referenced systems, softwares and database utility) and non-technical problems (i.e. economic, organisational, legal and community elements) that inhibit integrating, exchanging and utilising geospatial data from different sources (Crompvoets et al., 2008). Therefore, recently, many countries have considered tackling the fragmented and duplicated spatial data by reaching agreement for sharing fundamental geospatial datasets to achieve the geospatial information integration amongst government institutions and private agencies at the all levels. This phenomenon has created the concept of Spatial Data Infrastructure (SDI).

The SDI idea not only considers the technicalities of spatial data management, but is also concerned with managerial and human elements, which have high tendency to the organisational behaviour approaches. In terms of the organisational concept pertaining the spatial data sharing and exchange willingness, this thesis adapted Boonstra and Gravenhorst's (1998) organisational theory and Kok and Loenen's (2005) organisational models because the theory and model provide ways to represent SDI characteristics.

Various information systems scholars acknowledge that organisational performance requires successful information system implementation and management (Mähring et al.,2004; Doherty and King, 2001; Lambert and Peppard,1993; Williams, 1997 ; Suomi, 1994). Furthermore, the essential point of data or information sharing in an organisation's performance is an inter-organisational Collaboration-Cooperation-Coordination (3C).

In the past, only geographers or cartographers working in government agencies could create or produce geographic or geospatial data. Nowadays, through advanced devices, such as Global Positioning System (GPS), smartphones and cloud computing, geospatial data can be produced, collected, stored, disseminated, analysed, visualised and used by anyone (Sui *et al*., 2013). Gould (1999) argues that in this digital age, with advances in multiple types of devices which would be equipped by sensors for creating geographic features, everybody can be a geographer. Yet there has been little consideration of how spatial data or geographic information sharing practices take place. A person or a group of people untrained in cartography and working outside government agencies may create and produce spatial data voluntarily (VGI).

In terms of enhancing democratic spatial planning practices, VGI is considered as an effective voluntary method of making people with the tool and other co-participants in order to shape coalitions of local knowledge (Craig and Elwood, 1998). Notwithstanding that VGI is a useful approach to empower local stakeholders in terms of spatial planning, VGI participants from different professions, ages and education levels may produce poor quality spatial data which is less accurate, using different georeferenced systems, and a variety of scales. Therefore, in VGI mechanism still needs individuals who have geospatial knowledge and skill in VGI team supervisor as primary spatial data quality assurance from their contributors.

In relation to the research methods for this research, no single methodology, whether qualitative, quantitatve or mixed-methods is perfect to examine spatial data sharing. However, using qualitative methods to examine the potential integration of official spatial data and crowd-sourced geographic information in spatial planning formulation at the very early stage of adoption for the Indonesian context was judged to be the most appropriate. The qualitative methods in this thesis were helpful for exploring the Indonesian government's initiative from organisational, governmental, bureaucratic, policy and community participatory perspectives.

11.6 How the integration of SDI and VGI can enhance democracy in spatial planning

The potential of the NSDI and VGI integration model in supporting the spatial planning process can be implemented in spatial planning formulation at all levels (national, provincial, regency/municipal spatial planning systems) (See Figure 11.1).

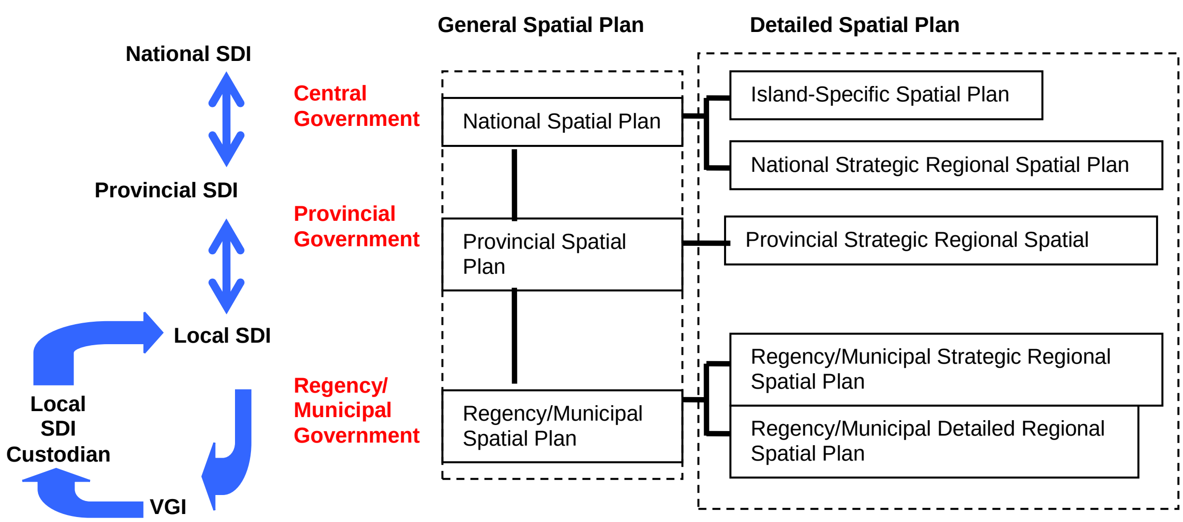


Figure 11.1 The NSDI and VGI Integration Model in terms of Enhancing Transparency In Indonesian Spatial Planning System

Figure 11.1 shows the provision of up-to-date spatial data for accelerating spatial planning enactment at provincial and regency/municipality levels. A traditional top-down SDI approach can be implemented for data sharing amongst Indonesian

Ministries and other government agencies at different levels. In fact, one of the weaknesses of SDI is a lack of up-to-date spatial data. Therefore, one of the solutions to overcome this lack is to involve VGI in local spatial planning processes. In terms of the current local spatial planning trend, the planning method requires the use of a bottom-up approach, thus participatory planning should be involved at the lowest planning level. In contrast, the top-down approach at provincial and national spatial planning levels is still needed for national security and defence issues.

The integration of VGI into SDIs will require extensive rebuilding of spatial data streams and institutional plans. The NSDI and VGI integration model presents spatial data streams which are genuinely two-way and include plans of action. It enhances transparency and ease of working in a transparent environment, and it is an important step towards developing more democratic processes in spatial planning.

SDI has emerged as a reaction to create good governance environment and the need to better oversee assets through enhanced collaboration, cooperation, coordination, and decreased duplication. On the other hand, lack of some SDI capacities (i.e. updating spatial data in real time series) may encourage integration with VGI by empowering public as citizen sensors.

This studies shows that the information provided by citizens is in the form of creating and sharing geographic information that uses their knowledge of their local situation and surrounding areas included in the government's development planning agenda. To assess the technical aspects of potential integration of SDI and VGI in the context of spatial planning, one of the case studies, viz. Surabaya Municipality was examined through the seamless official digital spatial planning visualisation with OSM spatial data (See Figure 11.2).

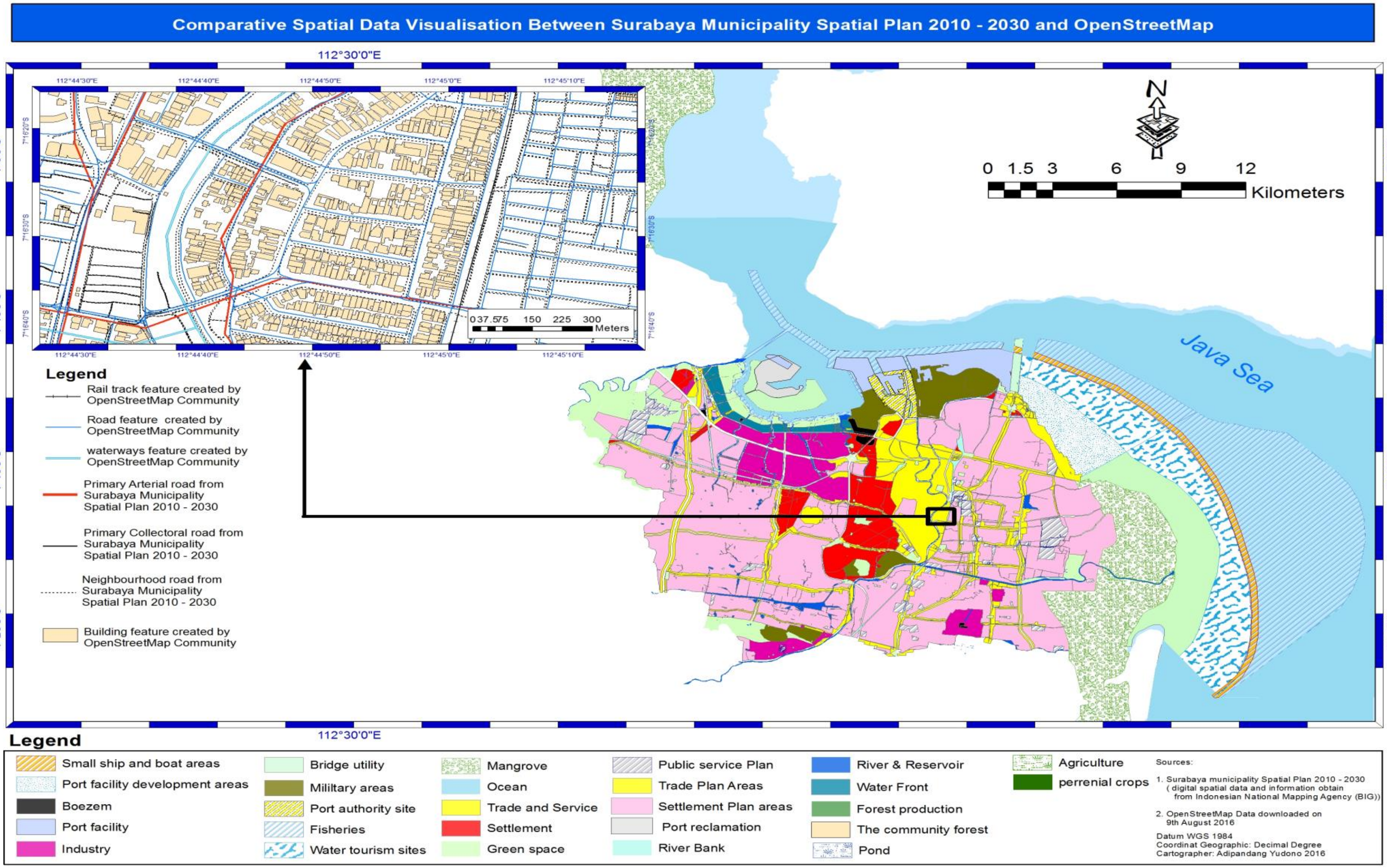


Figure 11.2 Comparative Spatial Data Visualisation Between Official Surabaya Municipality Spatial Plan and OpenStreetMap Data

The data visualization analysis of overlay OSM with official spatial data created by the government of Surabaya Municipality shows fixed and matched visualization. These findings suggest that the spatial data created by the OSM community has the potential to be integrated with official spatial data produced by government of Surabaya Municipality.

This chapter presented an attempted to answer the final research question: " How can SDI and VGI integration enhance democracy in spatial planning?" In terms of spatial data sharing, NSDI and VGI have their specific benefits and drawbacks. NSDI is good for qualitative spatial data, but not for quantitative spatial data; while VGI is good for quantitative data, but not for qualitative data. The crucial point for combining a top-down NSDI and a bottom-up VGI approach is regulatory enforcement, data standardisation and interoperability.

11.7 Conclusion and suggestion for further research

The study of spatial data and information sharing in government institutions cannot be separated from open data application in which the system of government agencies, which are concerned public service interests, are willing to publicly share their data and information. This provides explanation and transparency of government performance in terms of the implementation of development and planning agendas.

This study emerged from an interest in a policy focused on sharing national spatial data in Indonesia. It intends to achieve the integration of spatial planning programmes at all levels, which stresses the concept of the One Map Policy (OMP). The concept suggests unifying diverse geospatial information with fundamental and national thematic geospatial information. The idea of the 'One Map Policy' not only considers the technical aspects of spatial data infrastructure, but also non-technical GIS factors, such as strategic management, human resources capacities and institutional collaboration.

According to empirical findings of this study, official spatial data sharing implementation is still constrained. One of the reasons is a shortage of spatial data and information; however, there is an alternative solution through collaboration with civil society in voluntary spatial data production and provision –VGI.

This thesis has assessed potential spatial data integration between official spatial data and crowd-sourced geographic information, which predominantly looking from non-technical perspectives. The non-technical appraisal demonstrates that the integration of VGI into SDIs requires extensive rebuilding of data management, particularly human resources, policy and organisational factors, which have a significant impact on geographical information utilisation in government agencies and integration with VGI products.

The coherence and synergy of spatial planning can be achieved through dialogue between the elites and the public. A solution to bridge political communication between the elite and the public is sharing spatial data and information. In this, the *technicalities* of spatial data sharing are important factors for achieving consensus. Relevant non-technical issues, such as *social interactionism, political will, account, institution, assurance and reward,* as well as *leadership and legitimacy* factors are critical points for this potential spatial data sharing.

This thesis proposes the SPATIAL framework which the researcher developed along three models, viz. the model of organisational willingness to share spatial data within the SDI and VGI integration context; the stepped model of community participation to be involved in a government agency agenda; and the socio-technical model of SDI and VGI integration pertaining to the spatial planning context.

The findings of this research attempt to make a significant contribution to knowledge in bringing together the management of official spatial and crowd-sourced geographic information in planning practice. SDI and VGI integration will require extensive rebuilding of spatial data streams and institutional plans. The SDI and VGI integration approach presents spatial data streams, which are genuinely two-way and include plans of action. It enhances transparency and ease of working in a transparent environment and it is an important step towards developing a more democratic from spatial planning.

Indonesia as one of developing countries category with embracing immense annual growth rate of Gross Domestic Products (GDP), with more than 5%, as top of three countries (1st rank is India then followed by China) of highest GDP forecast groups compare to other nations under OECD members and its associates (G20, G7, European Union) for period 2009-2018 from OECD report in 2015 (see https://data.oecd.org/gdp/real-gdp-forecast.htm), might become the role model for other countries in terms of national development, include spatial planning practices. Furthermore, according to Masser (1998), Indonesia has recorded as one of from 11 nations (USA, Canada, UK, Netherlands, Australia, Portugal, Qatar, Japan, Korea, Malaysia and Indonesia) that constitute the first generation of national geographic information. This thesis as further study of NSDI of Indonesia might become the role model considers what lessons might be learnt to develop better NSDI and enhancing spatial information in spatial planning practice for other countries, particularly for developing countries.

The researcher concluded with an analysis of the management of spatial data and information sharing in government agencies at all administration levels and interactive mapping communities amongst citizens to indicate that the success of spatial data and information sharing can be achieved when government agencies can implement Collaboration, Cooperation and Coordination (3C) and citizens can actively participate in creating and sharing spatial data and information.

Ultimately, the researcher suggests examining the applicability of the case study findings in the context of other developing countries, for further research. This could be expected to produce better knowledge of spatial data sharing in developing countries and lead to better spatial planning practice.

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Appendices

Appendix A

List of Indonesian Governance Index Indicators

A. List of Indicators

No	Code	Indicators	Objective	Direct Observation	Questionnaire	Weight
Government						0.302
Participation						0.102
1	GIP1	Average number of proposed district development programmes considered Province Development Planning Deliberation Meeting			v	0.170
2	GIP2	Quality of Public Hearing in DPRD (local Parliament) in the Deliberation of Provincial Regulations			v	0.156
3	G2P1	The quality of public hearings to discuss Local Budget			v	0.219
4	G3P1	Quality of Governor consultation forum with stakeholders			v	0.092
5	G4P1	Quality of public complaint channels to strengthen DPRD monitoring function			v	0.199

6	G4P2	Quality of DPRD public engagement in conducting monitoring functions			v	0.164
Fairness						0.189
7	G1F1	Types of Formal government Institutions for Women's protection and empowerment	V			0.125
8	G2F1	Local budget (APBD) allocation for health (excluding civil servant expenditures) per capita adjusted to the price index.	V			0.243
9	G2F2	Local budget allocation (APBD) for poverty eradication per capita adjusted to the price index	V			0.228
10	G2F3	Local budget allocation (APBD) for the education sector per student (9 years compulsory education) adjusted to the price index	V			0.247
11	G3F1	Equal opportunity to join Governor Consultation Forum with Stakeholders			V	0.039
12	G4F1	Non-discriminatory conduct of DPRD (local Oarliament) in monitoring development			V	0.045
Accountability						0.259
13	G1A1	Consistency between Annual Development Targets stated in				

		Governor's Accountability Report (LKPJ) and target priorities stated in Mid-term Development Planning (RPJMD)	V			0.342
14	G1A2	Ratio of legalized local regulation to local legislation program (in %)	V			0.129
15	G1A3	Ratio of revised local budget to original local budget (APBD) without any changes in basic assumptions, emergencies and national policies	V			0.105
16	G2A1	Timeliness of enactment of local regulation (PERDA) concerning local budget (APBD)	V			0.190
17	G3A1	Ratio of grant/subsidy and social assistance expenses to goods and services expenses	V			0.110
18	G4A1	Local Parliaments' (DPRD) commitment to fight for public interests/aspirations			V	0.124
Transparency						0.190
19	G1T1	Accessibility of non-budget local regulations (PERDA) and Governor's regulations documents		V		0.172
20	G2T1	Accessibility of complete local budget				

		(APBD) documents		V		0.175
21	G2T2	Accessibility of Provincial budget accountability report through website		V		0.182
22	G2T3	Accessibility of information on Aspiration Fund spendings by local parliaments (DPRD)		V		0.160
23	G3T1	Quality of Governor's communcation in coordinating development			V	0.127
24	G4T1	Accessibility of monitoring activities by local Parliaments, e.g. executive summaries, minutes of meetings, field work visits by local Parliaments (DPRD)		V		0.183
		Efficiency				0.117
25	G1I1	Time needed to issue Governor's regulation concerning PERDA enactment	V			0.167
26	G1I2	Average time taken by local Parliament (DPRD) to pass local bills within the last year	V			0.167
27	G2I1	Ratio of civil servant expenditures (in both in direct and indirect spending accounts) to the total local budget (APBD)	V			0.463

28	G4I1	Ratio of local Parliament's (DPRD) budget to local revenues	V			0.202
Effectiveness						0.124
29	G1E1	Number of DPRD initiated local regulations per year	V			0.059
30	G1E2	Availability of regulations on environment protection		V		0.084
31	G2E1	Growth of GDP per capita	V			0.082
32	G2E2	Poverty rate	V			0.182
33	G2E3	Unemployment rate	V			0.222
34	G2E4	Gini ratio	V			0.169
35	G3E5	Percentage of women in Parliament	V			0.047
36	G3E1	Income disparity between districts in province (William Index)	V			0.086
37	G4E1	Ratio of Total Realized Expenditures to Total Revised Budget	V			0.069
Bureaucracy						0.323
Participation						0.095
38	B1P1	The existence of a Public complaint center (UPPM) in the Provincial Revenue Collection office		V		0.207

		(Dispenda)				
39	B2P1	The existence of Public Complaint Center in health, education and poverty eradication sectors		V		0.381
40	B2P2	The presence of a Health Board, an Education Board and a Poverty Eradication Board		V		0.169
42	B3P2	The presence of a regular forum between the provincial government and the public to strengthen investment climate, job creation and local economic empowerment		V		0.242
		Fairness				0.153
42	B1F1	Percentage of women civil servants at Echelon 2		V		0.070
43	B2F1	Percentage of medically-supported births (physician and midwife) to the total number of births	V			0.329
44	B2F2	Non-discriminatory public services provided for marginalized groups (women, poor, children, disabled, elderly, HIV/AIDS)			V	0.179
45	B2F3	Educational Ratio (mean years of schooling) between	V			0.251

		boys and girls				
46	B2F4	Performance of gender balance working group at provincial level		V		0.097
47	B3F1	Equal opportunities provided to engage in government project and tender			V	0.074
Accountability						0.204
48	B2A1	Provincial budget spending audited by State Auditor (BPK)		V		0.493
49	B3A1	Consistency between local economic policies, environmental protection policies and economic zoning areas			V	0.507
Transparency						0.217
50	B1T1	Accessibility of financial documents in local Bureaucracy offices (e.g. RKA SKPD, RKA PPKD, summary of DPA SKPD, summary of DPA PPKD)		V		0.405
51	B3T1	Accessibility of provincial investment regulations		V		0.595
Efficiency						0.160
52	B1I1	Ratio of Local Financial Management Office's (DPKD) overhead to realized local	V			0.241

		revenues				
53	B2I2	Ratio of civil servant's overhead expenditure (direct and indirect) to the total public spendings in provincial local budget (APBD)	V			0.386
54	B3I1	Investment services		V		0.378
		Effectiveness				0.172
55	B1E1	Ratio of DPKD's annual budget to the realized local revenues (PAD)	V			0.097
56	B2E1	Human Development Index	V			0.225
57	B2E2	Increase/decrease of water quality evaluated by the Environmental Quality Index between 2010 and 2011	V			0.405
58	B2E3	Increase/decrease of air quality evaluated by the Environmental Quality Index between 2010 and 2011	V			
59	B2E4	Increase/decrease of forest coverage evaluated by the Environmental Quality Index between 2010 and 2011	V			
60	B3E1	Investment growth	V			0.150

61	B3E2	Number of investment projects	V			0.124
Civil Society						0.208
Participation						0.205
62	C1P1	Quality of participation channels provided for civil society [by the government)			V	0.309
63	C2P1	Level of public involvement provided for civil society (by the government)			V	0.691
Fairness						0.174
64	C1F1	CSO's efforts in gender mainstreaming and empowering marginalized groups in advocacy and monitoring activities			V	0.618
65	C2F1	Variance or coverage of issues advocated and monitored by CSO			V	0.382
Accountability						0.183
66	C1A1	Quality of CSO's programme and finance reports			V	0.498
67	C2A1	Monitoring and evaluation Procedures for empowerment			V	0.502

		programs				
Transparency						0.218
68	C1T1	Accessibility of CSO's activities and institutional information				0.429
69	C2T1	Accessibility of information on CSO's activities related to local empowerment programmes				0.571
Efficiency						0.114
70	C1I1	Efficiency of CSO's advocacy and monitoring activities			V	0.578
71	C1I2	Coordination among CSOs in advocacy and monitoring activities			V	0.422
Effectiveness						
72	C1E1	Civil society's contribution to provincial corruption eradication effort			V	0.271
73	C2E1	Civil society's contribution to the improvement of provincial public services			V	0.377
74	C2E2	CSO's contribution to empowering marginalized groups			V	0.352
Economic Society						0.167

Participation						0.117
75	E1P1	Quality of participation in business association's decision making forums			V	0.383
76	E2P2	Involvement of business associations in formulating development policy			V	0.617
Fairness						0.171
77	E1F2	Equal opportunity amongst members of business associations for acquiring information, facility and participating in project tenders			V	0.320
78	E1F1	Business' response to labour demand for compensation/welfare related issues			V	0.324
79	E1F3	Acknowledgement and protection of female labor rights by economic society			V	0.356
Accountability						0.210
80	E1A1	Accountability reporting (program and finance) of business associations			V	0.196
81	E2A1	Business sector's compliance with tax and retribution			V	0.320
82	E2A2	Business sector's				

		compliance with regulations and business procedures			V	0.271
83	E3A1	Accountability in managing CSR programmes			V	0.213
Transparency						0.188
84	E1T1	Quality of transparency in implementing government projects			V	1.000
Efficiency						0.156
85	E1I1	Coordination amongst business associations to actively contribute to formulating development policies			V	0.321
86	E2I1	The use of environmental-friendly, sustainable energy and natural resources			V	0.679
Effectiveness						0.159
87	E1E1	Business sector's capability for settling/resolving conflict with the public			V	0.092
88	E2E1	Contribution of business sectors to providing ease of doing business and its climate			V	0.164
89	E3E1	Employment rate	V			0.745

Source: http://www.kemitraan.or.id/igi/index.php/framework/list-of-indicators

B. How to Read Indonesia Governance Index Indicator Codes

The IGI indicators have specific codes that assist in identifying each indicator. The Codes consist of 4 characters:

1. The first character (letter) refers to **Arena**
2. The second character (number) refers to **Functon** in the **Arena**
3. The third character (letter) refers to good governance **Principle**.
4. The fourth character (in a form of number) refers to order of indicator in each principle.

<table>
<tr><th>Arena</th><th>Function</th><th>Principle</th></tr>
<tr><td rowspan="4">G= Government</td><td>1= Regulatory Framework</td><td rowspan="11">P = participation
F = Fairness
A= Accountability
T= Transparency
I – Efficiency
E = Effectiveness</td></tr>
<tr><td>2= Budgeting</td></tr>
<tr><td>3= Development Coordination</td></tr>
<tr><td>4=Development Monitoring</td></tr>
<tr><td rowspan="3">B= Bureaucracy</td><td>1= Revenue Collection</td></tr>
<tr><td>2=Public Services</td></tr>
<tr><td>3=Regulating the Economy</td></tr>
<tr><td rowspan="2">C= Civil Society</td><td>1=Advocacy</td></tr>
<tr><td>2=Empowerment</td></tr>
<tr><td rowspan="2">E= Economic Socity</td><td>1= Advancing Business interest and Climate</td></tr>
<tr><td>2=Promoting Local Economic Activities</td></tr>
</table>

Example:

1. **G1T1**refers to the first indicator in **government arena** in **its first func)on** (regulatory framework) on the principle of **transparency.**

Appendix B

Basic and Thematic Spatial Data Usage under the General Directorate of Marine, Coastal and Small Islands

Spatial Data Types	Directorate of Marine Spatial Planning, Coastal and Small Islands	Directorate of Conservation Sites and Fish Species	Directorate of Coastal and Ocean	Directorate of Small Islands Empowerment	Directorate of Coastal Community Empowerment and Enterprise Development
BASIC SPATIAL DATA					
Basic Terrestrial Spatial Data					
• Contour	✓	✓	✓	✓	✓
• Bathimetry	✓	✓	✓	✓	✓
• Geology	✓	✓	✓		
• Marine Geomorphology	✓	✓	✓		
• Coast Lines	✓	✓	✓	✓	✓
• National Roads	✓	✓	✓	✓	✓
Basic Spatial Oceanographic Data					
• Current	✓	✓	✓	✓	
• Tidal	✓	✓	✓	✓	
• Wave	✓	✓	✓	✓	
• Salinity	✓	✓	✓	✓	
• pH	✓	✓	✓	✓	
Boundaries					
• Continent Boundaries	✓	✓	✓	✓	✓
• National Boundaries	✓	✓	✓	✓	✓

• Province Boundaries	✓	✓	✓	✓	✓
• Municipality/Regency Boundaries	✓	✓	✓	✓	✓
THEMATIC SPATIAL DATA					
Coastal Ecosystem and Fishery Resources					
• Coastal Ecosystems (Coral Reef, Mangrove, Seagrass)	✓	✓	✓	✓	✓
• Fish species and abundance	✓	✓	✓	✓	✓
• Exploration of exisiting sea region	✓	✓	✓	✓	✓
• Aquaqulture	✓	✓	✓	✓	✓
• Capture Fisheries	✓	✓	✓	✓	✓
• Tourism	✓	✓	✓	✓	✓
• Mining	✓	✓	✓	✓	✓
• Ports	✓	✓	✓	✓	✓
• Shipping Channels	✓	✓	✓	✓	
• Marine Life Channels	✓	✓	✓	✓	✓
Infrastructure					
• Road Networks	✓	✓	✓	✓	✓
• Drinking water networks	✓	✓	✓	✓	✓
• Electricity networks	✓	✓	✓	✓	✓
Resilience and pollution risk					
• Disaster Types	✓		✓	✓	✓
• Disaster Coordination Location	✓		✓	✓	✓
• Disaster Impact Boundaries	✓		✓	✓	✓
• Damage level	✓		✓	✓	✓

• Loss damage level	✓		✓	✓	✓
• Location source pollution	✓		✓	✓	✓

Appendix C

Thematic Spatial Database Served by BIG

Code	Category	Description	Sub-category
A	Spatial reference	Basic spatial framework dataset	1 Geodetic Reference Framework Network
			2 Geoid Model
			3 Tidal Stations
B	Terrirory Boundaries	Administrative territories boundaries dataset	1 Administrative boundaries
			2 Land territory boundaries
			3 Sea territories boundary
			4 Cadastre
D	Hydrography	Water body mapping and measurement (sea, seabed, port, rivers)	1 Water body in mainland
			2 Coastal Hydrography
			3 Coastline construction

			4	Water depth Information
			5	Fishery facilities
E	Hipsography	Earth surface relief representation with particular elevation reference dataset	1	Relief
F	Vegetation	Vegetation cover earth surface	1	Producer vegetation types
			2	Transition vegetation types
			3	Woody vegetation types
			4	Wetland vegetation types
G	Built Environment	Earth surface constructed 0bjects	1	Settlements
			2	Commercial areas
			3	Industrial areas
			4	Government areas
			5	Education areas
			6	Worship sites
			7	Tourism and

			cultural events sites
			8 Cemeteries
			9 Hospitals
			10 Public spaces
H	Infrastructure	Infrastructure Utility network dataset	1 Drinking water networks
			2 Electricity network
			3 Telecommunications network
			4 Gas and oil pipeline network
			5 Waste channels
I	Geology	Physical Earth Characteristics, structure and composition dataset	1 Mineral
			2 Energy
J	Land/Soil	Land/soil dataset	1 Land capacity
			2 Land value zones
			3 Site value asset zones
			4 Soil characteristics
K	Toponymy (Place name	The Place-name description	1 Geographical

	directory)	dataset		name
Z	Specific Dataset	Earth objects with specific uses	1	Hydrology
			2	Oceanography
			3	Land system
			4	Biodiversity
			5	Seabed relief
			6	Earth magnetic variation
			7	Meteorology
			8	Climatology
			9	Geophysics
			10	Disaster
			11	Spatial planning

Appendix D

SRI 2014 Assessment for Province Level

Province	Total Score	Organisation	Human Resource	Technology	Data
JAWA BARAT	76,00	26,00	10,00	20,00	20,00
NUSA TENGGARA BARAT	73,50	25,50	10,00	19,00	19,00
EAST JAVA	71,00	22,00	16,00	17,00	16,00
SUMATERA BARAT	68,18	17,00	11,18	20,00	20,00
NANGGROE ACEH DARUSSALAM	64,50	16,50	10,00	18,00	20,00
DAERAH ISTIMEWA YOGYAKARTA	58,50	17,00	14,00	7,00	8,75
SULAWESI TENGGARA	58,50	28,00	12,50	4,00	14,00
KALIMANTAN SELATAN	57,25	21,50	9,75	12,00	14,00
BANGKA-BELITUNG	49,50	21,00	6,50	4,00	18,00
KALIMANTAN TIMUR	48,50	12,00	11,50	16,00	9,00
BALI	46,50	11,50	8,00	11,00	16,00
SUMATERA SELATAN	44,00	21,00	4,00	6,00	13,00
JAWA TENGAH	42,00	8,00	3,00	13,00	18,00
KEPULAUAN-RIAU	42,00	16,00	5,00	5,00	16,00
BENGKULU	40,25	16,00	11,25	3,00	10,00
MALUKU UTARA	40,00	21,00	6,00	1,00	12,00
JAMBI	38,75	14,00	7,00	8,75	9,00
PAPUA	38,00	12,00	4,00	8,00	9,00
PAPUA BARAT	38,00	18,00	4,00	13,00	3,00
BANTEN	35,25	13,00	6,00	3,25	13,00
LAMPUNG	32,50	11,50	4,00	13,00	4,00
KALIMANTAN BARAT	31,25	12,00	4,00	5,75	9,50
DKI JAKARTA	29,50	12,00	7,00	1,00	9,50
RIAU	27,00	4,00	1,00	3,00	19,00
MALUKU	26,50	10,00	2,00	5,00	9,50
SUMATERA UTARA	23,00	12,00	2,00	2,00	7,00
SULAWESI BARAT	12,00	0,00	0,00	0,00	12,00

Source: BIG (2014c)

Note: From the five SDI pillars (data, human resources, technology, organisation, policy), I-SRI study of Provincial level merged **policy** and **organisation** into one group assessment of **organisation**)

Appendix E

I-SRI 2014 Assessment for Regency/Municipality Levels

NO	PROVINCE	REGENCY	Total Score	Organisation	Human Resource	Technology	Data	Rank
51	JAWA BARAT	KOTA DEPOK	81,50	28,00	10,50	21,00	22,00	1
111	NANGGROE ACEH DARUSSALAM	KOTA BANDA ACEH	73,75	20,00	17,00	9,25	27,50	2
13	BANGKA-BELITUNG	BELITUNG	67,25	28,50	9,75	7,00	22,00	3
90	NUSA TENGGARA BARAT	SUMBAWA	60,50	17,50	9,00	18,00	16,00	4
85	JAMBI	SAROLANGUN	54,50	25,00	8,50	7,00	14,00	5
81	SUMATERA SELATAN	KOTA PALEMBANG	54,17	0,00	0,00	0,00	0,00	6
79	SUMATERA SELATAN	OGAN KOMERING ILIR	53,50	19,50	8,00	14,00	2,00	7
98	JAWA TENGAH	WONOSOBO	52,27	0,00	0,00	0,00	0,00	8
3	BALI	BADUNG	51,50	16,50	4,00	9,00	22,00	9
5	BANGKA-BELITUNG	BANGKA BARAT	51,50	28,00	5,50	1,00	17,00	9
102	KALIMANTAN TIMUR	KOTA SAMARINDA	50,00	17,00	7,00	9,00	17,00	10
40	JAWA TENGAH	KEBUMEN	49,24	0,00	0,00	0,00	0,00	11
14	BANGKA-BELITUNG	BELITUNG TIMUR	48,50	21,00	9,50	8,00	10,00	12
32	NUSA TENGGARA BARAT	DOMPU	48,50	17,00	7,50	8,00	16,00	12
83	PAPUA	PUNCAK	48,25	16,50	13,75	12,00	6,00	13
68	NUSA TENGGARA BARAT	LOMBOK UTARA	48,00	21,00	5,00	4,00	18,00	13
57	NUSA TENGGARA BARAT	KOTA MATARAM	47,25	14,50	2,75	11,00	19,00	14
37	BALI	JEMBRANA	47,00	11,50	4,50	14,00	17,00	15
31	JAWA TENGAH	CILACAP	46,21	0,00	0,00	0,00	0,00	16
9	KALIMANTAN SELATAN	BANJAR	46,00	18,00	2,00	10,00	16,00	17
10	JAWA TENGAH	BANJARNEGARA	45,08	0,00	0,00	0,00	0,00	18
21	JAWA TIMUR	BLITAR	44,00	12,00	10,00	7,00	15,00	19
7	BANGKA-BELITUNG	BANGKA TENGAH	43,75	22,50	3,25	5,00	13,00	20
108	NANGGROE	GAYO LUES	43,50	8,00	6,50	16,00	13,00	21

	ACEH DARUSSALAM							
38	BALI	KARANGASEM	43,00	13,00	0,00	6,50	13,50	22
109	DAERAH ISTIMEWA YOGYAKARTA	GUNUNG KIDUL	43,00	12,00	2,00	11,00	18,00	22
107	JAWA TIMUR	SAMPANG	41,75	0,00	0,00	0,00	0,00	23
69	SULAWESI BARAT	MAJENE	41,50	18,50	6,00	4,00	13,00	24
76	BENGKULU	MUKO-MUKO	40,50	20,50	1,00	0,00	19,00	25
47	BENGKULU	KOTA BENGKULU	40,25	13,00	7,00	6,25	14,00	26
63	JAWA TENGAH	KUDUS	39,39	0,00	0,00	0,00	0,00	27
2	SUMATERA UTARA	ASAHAN	39,00	15,00	8,00	4,00	12,00	28
27	JAWA TENGAH	BREBES	38,64	0,00	0,00	0,00	0,00	29
52	PAPUA	KOTA JAYAPURA	38,50	15,00	2,00	8,50	13,00	30
58	BANGKA-BELITUNG	KOTA PANGKALPINANG	38,50	13,00	8,50	2,00	15,00	30
62	KALIMANTAN TIMUR	KOTA TARAKAN	38,25	12,50	2,75	5,00	18,00	31
41	BENGKULU	KEPAHIANG	38,00	15,00	8,00	1,00	14,00	32
49	JAWA BARAT	KOTA BOGOR	38,00	11,50	4,50	6,00	16,00	32
103	KALIMANTAN TIMUR	KUTAI KARTANEGARA	38,00	12,00	3,00	12,00	11,00	32
53	SULAWESI UTARA	KOTA KOTAMOBAGU	37,00	12,00	2,00	4,00	19,00	33
95	JAMBI	TEBO	37,00	22,00	4,00	3,00	8,00	33
60	KALIMANTAN BARAT	KOTA PONTIANAK	36,50	13,00	4,00	7,00	12,50	34
86	BENGKULU	SELUMA	36,00	15,00	6,00	7,00	8,00	35
11	KALIMANTAN TENGAH	BARITO UTARA	35,75	9,00	13,75	2,00	11,00	36
22	JAWA BARAT	BOGOR	35,50	9,50	2,00	7,00	17,00	37
4	BANGKA-BELITUNG	BANGKA	35,00	6,50	4,50	4,00	10,00	38
105	MALUKU	MALUKU TENGGARA	34,50	14,50	4,00	4,00	2,00	39
64	JAWA BARAT	KUNINGAN	34,25	10,00	4,25	3,00	17,00	40
50	BALI	KOTA DENPASAR	33,75	15,50	4,25	6,00	8,00	41
65	BENGKULU	LEBONG	33,75	10,00	3,75	3,00	17,00	41
92	JAMBI	SUNGAI PENUH	33,75	5,00	4,75	9,00	15,00	41
55	JAWA TIMUR	KOTA MALANG	33,50	20,00	2,00	0,00	11,50	42
66	KEPULAUAN-RIAU	LINGGA	33,00	7,50	4,50	2,00	19,00	43

114	KALIMANTAN TENGAH	MURUNG RAYA	32,50	18,00	2,50	2,00	0,00	44
59	SULAWESI SELATAN	KOTA PARE-PARE	32,00	11,00	2,00	3,00	16,00	45
6	BANGKA-BELITUNG	BANGKA SELATAN	31,75	7,00	7,75	2,00	15,00	46
20	KEPULAUAN-RIAU	BINTAN	31,50	9,50	2,00	6,00	14,00	47
77	PAPUA	NABIRE	31,50	14,50	2,00	0,00	15,00	47
104	SULAWESI BARAT	MAMUJU	31,00	15,00	0,00	0,00	16,00	48
61	KEPULAUAN-RIAU	KOTA TANJUNGPINANG	30,50	7,00	5,50	1,00	17,00	49
67	NUSA TENGGARA BARAT	LOMBOK TENGAH	29,75	8,00	6,75	3,00	12,00	50
93	KALIMANTAN SELATAN	TABALONG	29,25	15,00	3,25	0,00	11,00	51
36	PAPUA	JAYAWIJAYA	29,00	13,00	5,00	1,00	10,00	52
113	JAMBI	MUARO JAMBI	29,00	6,00	5,00	2,00	16,00	52
80	JAWA TIMUR	PACITAN	28,75	9,00	3,00	7,25	9,50	53
33	NUSA TENGGARA TIMUR	ENDE	28,30	0,00	0,00	0,00	0,00	54
24	SULAWESI UTARA	BOLAANGMONGONDOW TIMUR	28,00	4,50	1,50	7,00	15,00	55
116	SUMATERA BARAT	TANAH DATAR	28,00	10,00	2,00	0,00	16,00	55
8	JAWA TIMUR	BANGKALAN	27,50	7,00	4,50	1,00	15,00	56
97	JAWA TIMUR	TUBAN	27,27	0,00	0,00	0,00	0,00	57
28	JAMBI	BUNGO	27,00	7,00	3,00	2,00	15,00	58
74	JAMBI	MERANGIN	27,00	7,00	5,00	0,00	15,00	58
100	SULAWESI UTARA	BOLAANGMONGONDOW	26,75	6,50	6,25	1,00	13,00	59
117	JAMBI	TANJUNG JABUNG TIMUR	26,00	10,00	2,00	4,00	10,00	60
75	SULAWESI UTARA	MINAHASA	25,00	10,00	0,00	0,00	15,00	61
112	MALUKU UTARA	KOTA TIDORE KEPULAUAN	25,00	0,00	9,00	3,00	13,00	61
17	BENGKULU	BENGKULU TENGAH	24,50	10,00	6,50	0,00	8,00	62
54	SULAWESI SELATAN	KOTA MAKASSAR	24,50	11,50	2,00	0,00	11,00	62
23	SULAWESI UTARA	BOLAANGMONGONDOW SELATAN	24,00	9,50	1,50	0,00	13,00	63
45	MALUKU	KOTA AMBON	24,00	3,00	3,00	0,00	18,00	63
46	KEPULAUAN-RIAU	KOTA BATAM	24,00	2,00	2,00	6,00	14,00	63
34	JAMBI	KOTA JAMBI	23,75	5,00	2,75	5,00	11,00	64
72	SULAWESI	MAMUJU	23,50	3,50	4,00	2,00	14,00	65

	BARAT	UTARA						
1	NANGGROE ACEH DARUSSALAM	ACEH BARAT	23,00	4,00	4,00	6,00	9,00	66
25	SULAWESI UTARA	BOLAANGMONGONDOW UTARA	23,00	3,50	3,50	0,00	16,00	66
118	PAPUA BARAT	FAK FAK	23,00	7,50	1,50	0,00	14,00	66
48	SULAWESI UTARA	KOTA BITUNG	22,00	9,00	0,00	0,00	13,00	67
29	MALUKU	BURU SELATAN	21,50	16,50	1,00	0,00	4,00	68
73	SULAWESI SELATAN	MAROS	21,50	10,00	3,00	3,50	5,00	68
101	MALUKU	BURU	21,50	8,00	4,50	3,00	6,00	68
106	SULAWESI UTARA	KEPULAUAN SIAU TAGULANDANG BIARO	21,50	18,00	3,50	0,00	0,00	68
70	MALUKU	MALUKU BARAT DAYA	21,25	6,00	1,25	0,00	14,00	69
15	NUSA TENGGARA TIMUR	BELU	21,21	0,00	0,00	0,00	0,00	70
39	BENGKULU	KAUR	21,00	6,00	4,00	0,00	10,00	71
94	SUMATERA UTARA	TAPANULI TENGAH	20,50	12,50	0,00	0,00	8,00	72
18	BENGKULU	BENGKULU UTARA	19,50	11,00	3,50	1,00	4,00	73
16	BENGKULU	BENGKULU SELATAN	19,25	15,00	2,25	1,00	1,00	74
19	KALIMANTAN TIMUR	BERAU	19,25	2,00	3,25	7,00	7,00	74
115	BENGKULU	REJANG LEBONG	19,00	5,50	1,50	4,00	8,00	75
89	JAWA TENGAH	SRAGEN	18,94	0,00	0,00	0,00	0,00	76
99	SULAWESI BARAT	MAMUJU TENGAH	18,50	12,00	1,50	0,00	5,00	77
82	JAWA TENGAH	PEKALONGAN	18,18	0,00	0,00	0,00	0,00	78
110	JAMBI	TANJUNG JABUNG BARAT	18,00	0,00	5,00	3,00	10,00	79
12	JAMBI	BATANGHARI	17,00	4,00	6,00	0,00	7,00	80
84	JAWA TENGAH	REMBANG	16,67	0,00	0,00	0,00	0,00	81
42	MALUKU	KEPULAUAN ARU	16,00	0,00	2,00	0,00	14,00	82
44	KALIMANTAN BARAT	KETAPANG	15,50	8,00	2,50	0,00	2,50	83
87	JAWA TENGAH	SEMARANG	15,15	0,00	0,00	0,00	0,00	84
91	JAWA TIMUR	SUMENEP	15,00	4,00	4,00	4,00	3,00	85

43	JAMBI	KERINCI	14,75	3,50	2,25	0,00	9,00	86
56	SULAWESI UTARA	KOTA MANADO	14,50	1,50	1,00	0,00	12,00	87
96	JAWA TENGAH	TEMANGGUNG	12,88	0,00	0,00	0,00	0,00	88
26	SULAWESI SELATAN	BONE	11,00	0,00	0,00	0,00	11,00	89
71	SULAWESI BARAT	MAMASA	9,00	3,00	0,00	0,00	6,00	90
88	MALUKU	SERAM BAGIAN BARAT	7,50	1,50	0,00	0,00	6,00	91
78	JAWA TIMUR	NGANJUK	7,00	5,00	0,00	0,00	2,00	92
35	PAPUA	JAYAPURA	4,00	3,00	1,00	0,00	0,00	93
30	SULAWESI TENGGARA	BUTON	1,50	1,50	0,00	0,00	0,00	94

Source: BIG, 2014c

Note: From the five SDI pillars (data, human resources, technology, organisation, policy), I-SRI study of Regency/Municipality levels merged **policy** and **organisation** into one group assessment of **organisation**)

Appendix F

Interview transcripts and fieldwork notes give an expressive record of the review, however, they don't give clarifications. The researcher needs to understand the data that have been collected by investigating and interpreting them. The procedure of thematic content analysis is basically the same, in that it includes distinguishing subjects and classes that rise up out of the data. This includes finding them in the interview transcripts then trying to check, affirm and qualify them by looking through the data and perpetuating the procedure to recognise additional subjects and classifications.

In order to understand the research context through interviews and document analysis, once the interviews have been transcribed verbatim. The researcher understands the written words of every transcript and makes notes in the edges of words, hypotheses or short expressions that resume what is being said in the content. This is what is called coding activity. In this section, the researcher explains an overview procedure of coding process from interview and document analyses to generating potential SDI and VGI integration issues as depicted in Figure 10.1.

The step by step coding activities for identifying potential of SDI and VGI integration issues in this research are described below:

1. Generating open coding from interview transcripts

Table 1. An overview of an open coding process

Interview transcripts	**Open coding framework**
An example of Interview at central governmmet level	
Interviewer: *Is there any potential integration of official spatial data and crowd-sourcing geographic information generated by citizens?*	
Respondent: ***In BIG (The Indonesian Mapping agency), the integration potential is***	• Political situation • Communication between government to citizens

high because BIG has an authority to coordinate all existing spatial data and information for national development interest. *BIG has accommodated spatial data generated by citizens through Petakita geoportal (**http://petakita.ina-sdi.or.id/pempar/**). However, due to the* ***lack of communication to citizens****, the use of geoportal was not really effective.*	
Interviewer: *How about the NSDI itself, is there any problem in its implementation in Indonesia based on your point of view?*	
Respondent: ***The impediments happening today regarding the NSDI problem are the unclear custodian roles of government institutions and lack of willingness of government institutions to open/share their data.*** *They still think that NSDI means they should make spatial data from start and then distribute them to other government institutions.* ***They miss-understood about NSDI concept.***	• Unclear custodian role • Willingness for openness • Miss-understood of NSDI concept
An example of Interview at provincial government level	
Interviewer : *Based on your point of view, what are opportunities and impediments to spatial data sharing encountered*	

in your provincial government circumstance?	
Respondent : ***The opportunity for implementing spatial data sharing in our provincial agencies circle is high; all governmental sector agencies have committed to share their data for provincial development purpose. If I ask spatial data for particular interest in other government sectors, they gave it to me voluntarily without complicated bureaucracy, for example, last week, I've just visited Bima Regency Planning Board Agency, when I asked their spatial data, they gave me satellite imagery data without hesitation.***	• Organisations commitment
Interviewer: *How can spatial data sharing be easily achieved in this province?*	
Respondent: ***Mostly, it (spatial data sharing) happened due to friendship bonds**. Of course this does not happen every time and every where, some areas do not want to share their data, **usually because the staff needs to get approval from the highest authority in their institutions.***	• Friendship relationship • Leader mindset • Bureaucracy reasons
An example of Interview at municpial government level	
Interviewer : *Based on your point of view, what are opportunities and impediments to spatial data sharing encountered*	

in your municipal government circumstance?	
Respondent: ***The opportunity of spatial data sharing may exist, if it is supported by the leader in each government institution*** *from the highest up to lowest position (From the head of particular municipal sector agency to head of their working units under particular municipal sector agency)****. A leader support in each institution, means there is guarantee and legitimacy*** *for municipal government programmes, for example financial and human resources allocations regarding spatial data management can happen and spatial data sharing can exist in the future. Furthermore,* ***budget allocation for spatial data management gives a little help to develop a spatial database.***	• Leader mindset • Guarantee and legitimacy from organisation leader • Financial supports
An example of Interview to Indonesian Humanitarian OpenStreetMap Team Administrator the municipal government level	
Interviewer : *In terms of Indonesian NSDI, are there any discussions for integrating OSM data with official spatial data that coordinated by BIG?*	
Respondent: ***For us, we will be happy if the Indonesian government ask to collaborate with us****, but there had been some talks with one of the official person from BIG*	• Willingness to collaborate • Political circumstance • Geoportal Server

at the FOSS4G Asian meeting in Bangkok in 2014 regarding that issues. From the informal meeting, ***I felt that the officer looked unhappy, because the Indonesian OSM server is not located in Indonesia****, but in Denmark.* ***He wants the Indonesian OSM server to locate in Indonesia, so that BIG can control it and can manage for integration.***	
An example of how to look for substantial keywords from Official documents	
Based on data from the Ministry of Public Works, Directorate General of Spatial Planning, there are some areas that have not completed the spatial planning regulation yet until 2014, which are consists of 8 provinces, 79 regencies and 12 municipalities. While the progress made in drafting the spatial plan maps (*Peta RTRW*) at the province, regency and municipality are still far from completion target, **it was due to the preparation of spatial plan maps tends to require specific skills and the situation was not supported by data, technology and adequate human resources.** These happen for several reasons: a) **The local government did not acknowledge how**	• Local government attention to spatial data or information • Organisational commitment • Spatial data limitations • Human resource limitations • Limited geospatial technology

importance of accurate Geospatial Information in spatial planning; **b) Human resources who can operate GIS in local governments and private sectors are limited;** **c) Spatial data (Basemap and Spatial thematic information) regarding spatial planning purpose is limited;** d) Spatial plan map guidance is limited. Source: *Grand design percepatan pemetaan tata ruang dalam kerangka program kebijakan satu peta 2015-2019* (Grand design of spatial plan mapping acceleration within the One Map Policy framework 2015-2019), BIG (2014)	

2. Classifying similar or resemble meaning of open coding framework (Axial coding)

Table 2. An overview of transforming open coding to axial coding	
Open Coding Framework	**Axial Coding Framework**
• Political circumstance • Local government attention to spatial data or information	Political issues
• Organisation willingness for openness • Missunderstood of NSDI concept • Friendship relationship	Communication issues

• Willingness to collaborate	
• Financial support	Financial issues
• Geoportal server • Spatial data limitations • Limited geospatial technology	Technology issues
• Unclear custodian role • Organisational commitment • Bureaucracy reasons • Human resource limitations	Organisational issues
• Guarantee from organisation leader	Guarantee
• Leader mindset • Legitimacy from organisational leader	Leadership and Legitimacy

3. Finally, integrating keywords that involved in one group of axial coding into a new classification (Selective coding)

Table 3. An overview of transforming Axial coding to Selective coding

Axial Coding Framework	Selective Coding Framework
• Political issues	**Political will**
• Communication issues	**Social interactionism**
• Financial issues	**Accounting**
• Technology issues	**Technology artefact**
• Organisational issues	**Institutions**
• Guarantee	**Assurance and Rewards**
• Leadership and Legitimacy	**Leadership and Legitimacy**