Implementing Spatially Enabled Government (SEG) Concept in Indonesian Local Government, challenges and opportunities

Heri Sutanta[1,2], Abbas Rajabifard[1], Trias Aditya[2]
[1]Department of Geomatics, University of Melbourne
[2]Department of Geodesy and Geomatics Engineering, University Gadjah Mada

Most government decisions and action at national and local levels have a spatial component. Local government activities with spatial components include, but are not limited to, spatial planning, land management, taxation, and the issue of building and site permits. A framework for governing spatially related activities needs to be formulated. An emerging concept of Spatially Enabled Government (SEG) is currently being developed, refined and implemented in many countries. SEG will increase efficiency, transparency and accountability of government activities. This paper will discuss the SEG concept, its prospects and challenges when implemented in the context of Indonesian local government.

Local government in this paper refers only to district (kabupaten/kota) level. The following data were used: survey on local government's website and questionnaire. Of the 479 districts in Indonesia, official websites of 442 districts established after 2006 were surveyed. Questionnaires were sent out to 71 districts, with 34 responses being received. The questionnaire covered areas of organization, human resources and spatial data infrastructures (SDIs). It was designed to investigate the existing capacity and understanding of local government spatial governance, specifically at the local planning agency.

Website surveys revealed that local government had limited interest in exploiting the virtually unlimited potential of internet for spatially-related government activities. SDI, as an enabling platform for data sharing and exchange among government agencies, has not been considered important. Comprehensive policies on spatially-related government programmes were limited. Finding from the questionnaires indicates that funding and qualification of human resources were the main responsible factors for this situation. Local governments have limited staffs with expertise in spatial data handling. Some recommendations to overcome the challenges and impediments are presented. Although there are challenges and impediments, SEG may still be implemented in local government provided some necessary conditions are met. Recent central government initiatives on national spatial data infrastructure (NSDI) and telecommunication infrastructure, which will be implemented in the near future, are essential to speed up the process of creating better spatial data governance in local government.

Key words: spatially enable government, local government, implementation, challenges, opportunities

1. Introduction

Everything happens, happens somewhere, in a specific location. Knowledge on where particular activities or events occur, thus, has some degree of importance. This situation is applicable for any local or national government activities in facilitating better spatially-informed decision making. Figure 1 show how spatial information functions in locating, connecting and delivering services to public. O'Looney (2001) suggested that approximately 80% of local government activities have spatial components. These ranges from site permit issuance, and land use planning, to property taxation. Spatial information plays an important role in decision making in different sectors, ranging over economic, environment, politic, and social aspects (McDougall *et al.*, 2005). Its importance lies in the government activities of:

land use planning and permit issuance monitoring, infrastructure and transportation planning, property taxation, site selection, emergency management, etc.

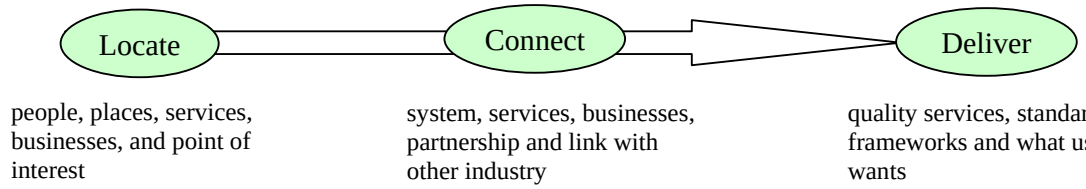

Figure 1. Function of spatial information in locating, connecting and delivering services (from Rajabifard, 2008).

The collection of accurate and timely-relevant spatial information has significant relevance in facilitating better-informed decision making process. They are used in location-based analysis of planning to obtain important geographic correlation. They also serve as a visualization tools for the identification and depicting the location of current events, planned activities or the areas to be affected by particular development activities. Current practice indicates that there is an increase in the use of digital spatial database in inter-agency meetings. Laptops, equipped with geographic information system (GIS) software and portable viewer have been used more frequently to visualize spatial information to those attending the inter-agency meeting. This method significantly increases the user experience and engagement in the use of spatial information, by being able to zoom, pang and extract information from databases. Traditional methods of using printed maps did not allow for these operations. However, in this new method, spatial information is remains exclusive information known, utilized and controlled by only a few people. Public participation is limited, due to the unavailability of spatial information to the general public and because of time-space limitation. It seems that public access to the spatial information managed by the government is very limited.

Public participation is required in many development activities, not only because it will affect their living space, but it is mandated by government laws and regulations. As an example, spatial planning law (UU 26/2007), requires that information relating to spatial planning should be made available to the public. It will ensure public understanding of spatial planning, encouraging active participation and minimizing potential law-breaching activities. The public can provide comments on published maps and returning new thematic information. This situation can only be accomplished as long as the prerequisite factors are fulfilled, for example:

a. a policy on spatial information management and e-government
b. an infrastructure for data sharing, exchange and dissemination,
c. a critical mass of users.

The introduction of Google Earth and Google Maps in 2005 had a significant influence on the public use and understanding of spatial information. These were followed by Microsoft Virtual Earth, Open Street Map and NASA World Wind. All of these online maps have created a critical mass of people who are aware of the use and power of spatial information in everyday activities. They can use online mapping application for various applications, from looking for directions, finding addresses of restaurant or government building, and exploring environmentally interesting features, and much more.

Use of free and online spatial information is increasingly a serious business. Not only in part of the system provider, such as likes Google and Microsoft, but at the user side. They are not

only useful for personal activities but also have potential significant benefit to the community. One of the earliest examples of large scale use of Google Earth and Google Maps was during Hurricane Katrina and Typhoon Nargis. They were used to pin-point the location of victims, and assist in the management of aid distribution and emergency response teams. This map-based visualization assists in preventing duplication in one area and omission in others. Data for this information were feed by thousands of volunteers and rescuers in the field, as voluntarily geographic information (VGI). Google Earth and Google Maps were also used during the earthquake disaster in Yogyakarta, 27 May 2006 (Arsana, et al., 2006). At a later stage, Aditya (2007) used a customized Google Maps application in an effort to encourage public participation in infrastructure development.

These progresses and innovations are valuable in supporting government activities. However, isolated and sporadic innovation will have little benefit to the community if they are not formalized in broader context as a government policy. Formalization and institutionalization should serve as a foundation for cross-jurisdictional collaboration among government agencies at all levels. International analysis shows that operational responsibility of SDI is now at local government level, while focus at the national level serves on strategic role (Williamson et al., 2007). Since central government already has adequate expertise and infrastructure, attention should be focused on local government level.

Why Local Government

Spatial information has been used for centuries. The first recorded activities dealing with spatial information was the measurement of land parcels in the Nile River Basin by the ancient Egyptians. It was used as a basis for the simple registration of property right at the fertile river bank which was used for agriculture field. These records were important to ensure tenure security because the annual flooding usually obliterated parcel boundary. Nowadays, the use of spatial information has reached various sectors, beyond the imagination when those first maps were created. Spatial data producers and users have increased increase significantly over the years, leading to the requirement of infrastructure for better management of data sharing and exchange. The evolution of spatial data utilization can be seen from spatial data production, management, and retrieval of relevant information to data sharing and exchange. With relatively large amount of spatial data have been produced and held at different organizations and different level of government, it is now urgently required to have a platform for inter-agency data sharing, exchange and collective use, known as spatial data infrastructure (SDI). SDI denotes “the relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data” (GSDI, 2009).

At the earlier stage, SDI was developed at the national government level, considering technical capabilities and resources then available. Strategic direction and daily operational activities were also conducted at the national level. The role of local government and the private sector was limited, while their activities were un-coordinated. As shown in Figure 2, the current situation is likely to change. The national government’s role in strategic matters remains the same, but the operational aspect is currently implemented by the local government and the private sector. This changing situation shows the importance of local government.

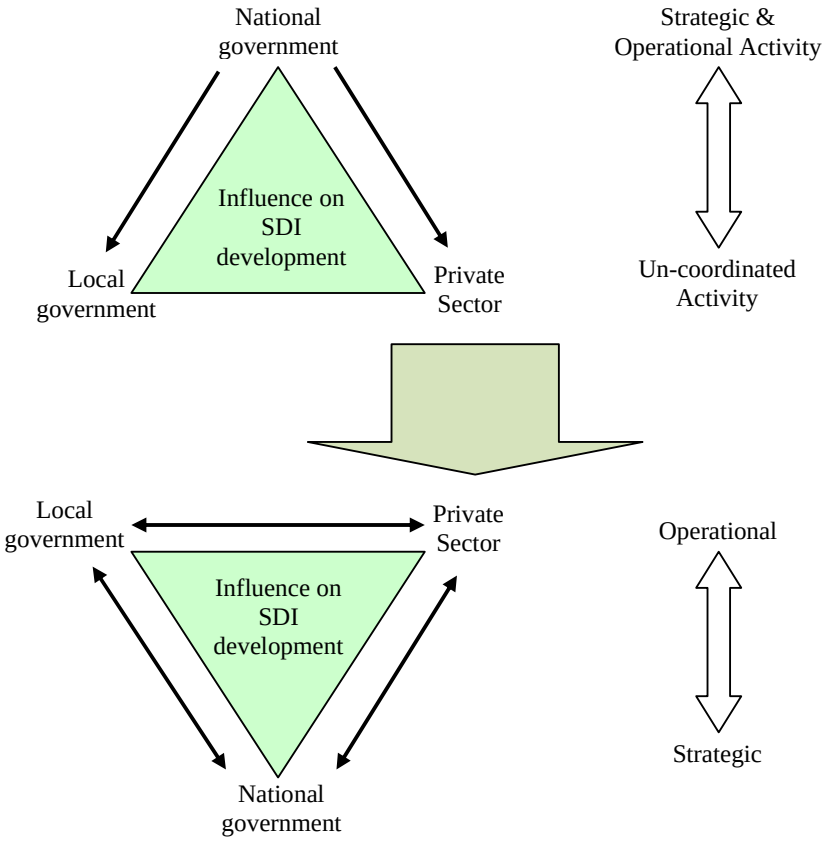

Figure 2. Evolution of roles of national government, local government and the private sector in SDI development from over the past 10 years -above- and current situation -bottom- (Williamson et al. 2007, pp:121-132).

The use of spatial information in Indonesian government in the last two decades has increased substantially, not only in those organizations that traditionally dealt with spatial data. Two main government agencies that were traditionally involved with, and have a mandate to produce, spatial data are the National Coordination Agency for Surveys and Mapping (Badan Koordinasi Survei dan Pemetaan Nasional: Bakosurtanal) and the National Land Agency (Badan Pertanahan Nasional: BPN). Bakosurtanal has the responsibility for the development and maintenance of the national geodetic networks, the production of topographic maps and the national atlas. BPN's main tasks are the mapping and registering of land parcel, ensuring the legal relations between land and people are secure. While the products of BPN were mainly used internally, the products of Bakosurtanal were used extensively by other government agencies and the private sectors. There are now other government agencies working on production of spatial data, usually within specific themes, such as the Geological Agency, the Public Work, the Hydro-Oceanographic Agency, and the Department of Forestry. At the national level, there is a large number of agencies dealing with spatial data and possessing sufficient qualified technical staff. However, this is not the

case for local government. Furthermore, there is still a need for more seamless coordination and integration (Adiyta, 2009), in both national and local level.

Local government consists of the provincial and district/city levels. In this paper, local government refers to the district/city level. Until 2008, the number of districts/cities was 483. Almost every year new districts/cities were formed, which from the spatial viewpoint will have several consequences, the least of which is changes in their administrative boundary. In the local government, spatial data is usually managed by the Local Planning Agency (Badan Perencanaan Pembangunan Daerah: BAPPEDA). They have the capability in managing, maintaining and publishing spatial information, especially that related to spatial planning, population and resources. Some other government agencies at the district/city level are also frequent user of spatial data, such as Public Works, Forestry, and the Land Agency. However, some of these are actually reporting to central government and formally have no direct responsibilities to the local government. This situation will create difficulties in establishing cooperation and collaboration on spatial data utilization.

The situation in local governments is varied, in terms of human resources, infrastructure, funding and institutional capacity. Some of them have good and qualified staff, excellent infrastructure and generous funding. On the other hand, many of them, especially those who located in remote areas or islands, are limitedly equipped. There is digital divide among them, represents the variation in their IT capacity. Many local governments in Java Island and provincial capitals usually have state of the art IT infrastructures with adequate bandwidth. For the private sector, there are many internet service providers who can facilitate good internet connection. In the less developed districts, sometimes a few Mbps of bandwidth need to be shared for tens of government agencies. Finding internet kiosks is also not an easy task. Within this situation, this paper try to explore what challenges and opportunities faced by local government if they want to increase the use of spatial information in governing their area, in the context of spatially enabled government.

2. Spatially Enabled Government

2.1. Defining the Concept

The terms spatially enable government (SEG) or spatial enablement of government have just been coined recently, starting from Australia and then spreading to Asia, Europe and US. It seems that there is currently no agreement on the exact and widely agreed definition of the terminology (Holland, 2009). The main idea in SEG is where government puts spatial information in digital form on the web and makes it accessible to citizens and business (Wallace et al. 2006), to increase transparency and accountability of government activities and encourage further development of value added product. In other words, SEG is an effort to spatially manage government information. Regionally, from 2006 to 2008, the Permanent Committee for GIS Infrastructure for Asia & Pacific (PCGIAP) set up a working group to investigate SEG concept and implementation. One of the outcomes was the first workshop on SEG, which was conducted in South Korea in 2007. The workshop endorsed the concept of SEG and stated the significance of SEG as “an important tool to improve effectiveness, efficiency, better decision making, business processes, and policy implementation, nationally, regionally, and globally”.

The internet is the key enabler in development of SEG. It is the platform with which spatial information dissemination, collaboration between stakeholders and participation from the

community can be realized. In the pre-internet era, spatial information had to be delivered in printed form, reducing its interactivity and mobility. Printed maps are not convenient, difficult to transport and require considerable time and efforts for updating. Collaboration and public participation using printed map are limited to same time – same place (STSP) models. Same time – different place (STDP) collaboration is difficult to implemented, if not impossible. Currently, using and sharing of digital spatial databases are common practice. Its utilization was begun in the early as 1990 by the national mapping agency and the national land agency. Other central and local government agencies are following, but mainly as users. The limiting factor is the availability of staff capable of maintaining digital spatial data.

The internet offers some advantages which enable dissemination of digital spatial information online. At the very beginning, it can only be used to display map on the website using image format (jpg, png, tiff) or pdf. At the end of 1990s, internet GIS was beginning to emerge. It has some GIS functionality which can be executed online, allowing users to interact with maps and retrieve required spatial information from the underlying databases. In the internet web 1.0, information dissemination was mainly one-sided, from data producers to user. Internet web 2.0 offers dynamic and two-way communications between data providers and their users. Users can provide input to the published spatial information. This marks the era of social networking and community participation, which partly laid the foundation of SEG.

2.2. International Trends

Implementation of SEG has been commenced in a number of countries in the last decade, whether or not named as a SEG. It appears that there is strong correlation between countries which have already implemented SEG and their e-government readiness index. These countries usually have a high ranking in their e-readiness index and e-Government readiness index. E-readiness index is a term used by *The Economist* to measure the quality of ICT infrastructure, and the ability of consumers, business sector, and government to derive benefit from it. In its annual survey, seventy countries are indexed (The Economist, 2009). Similar measure was used by the United Nation to identify readiness of countries in delivering e-Government services using the internet. In 2008, 189 countries were surveyed, measuring five primary indices of (DESA, 2008):

- Internet users / 100 persons.
- PCs / 100 persons
- Main telephone lines / 100 persons
- Cellular telephones / 100 persons
- Broad band / 100 persons

There are a number of countries which have already implemented partial or whole concept of SEG. Four countries are taken as examples: the United States, the United Kingdom, the Netherlands and Australia. These countries were ranked among the best in e-readiness index and e-government readiness index. In the e-readiness index, United States, United Kingdom, the Netherlands and Australia were ranked number 5, 13, 3 and 6, respectively. In the e-Government readiness index, they were ranked number 4, 10, 5 and 8, respectively.

The United States is the pioneer in the development of modern technique for spatial data acquisition and managements. Almost all of the leading companies in the spatial information industry are operating within the US jurisdiction. The government facilitates, and enjoys,

innovation from the private sector for the benefit of its citizen. Numerous agencies at the federal and state level provide spatial information at their websites, for example NASA, USGS and EPA. This situation really empowers citizen and equips them with required knowledge on their living space.

The United Kingdom was one of the early adopters of SEG, especially in the spatial planning domain. The website at <http://www.planningportal.gov.uk/> is a portal for all information regarding planning matters in the UK. Every local government body is required to develop its own portal to address local requirements. Information on these portals includes planning and building regulations, planning permit application, appeals on the decision and access to development information for a particular location. Users are classified in three categories: general public user, professional user and government user. UK's national mapping organization, Ordnance Survey (OS) was among the first to introduce the use of internet for spatial information dissemination. Its website, at <http://www.ordnancesurvey.co.uk/>, has wealth of information on spatial data and how to obtain them.

The Netherlands has two portals dealing with provision of spatial information to the public, Netherlands Kadaster (http://www.kadaster.nl) and from the Ministry of Housing, Spatial Planning and Environment - VROM in Dutch (http://www.ruimtelijkeplannen.nl/web-roo/). Netherlands Kadaster's portal provides information on land parcels, who owns a particular parcel as well as associated rights and restrictions that applying to that parcel. Visitors can create a query to ask whether a particular parcel has any mortgage and when it will be paid off. This information is very helpful if an investor is seeking a space for commercial development. The investor does not have to go to local or regional Kadaster office to obtain this information, thus saving time and money. Netherlands Kadaster does not receive government funding but is funded by charging the public for using its data. However, they are restrained from profit taking. All of its revenue must be used for operational costs and investments. The spatial planning portal of VROM aimed to transparently provide spatial plans to citizens, private institutions and government agencies. It covers data from all level of government – state, province and municipality. The new law of spatial planning requires that all municipalities make their spatial plans digitally available online by 1st January 2010 (Georgiadou and Stoter, 2010).

Australia's effort in SEG had its beginning at the conference on Spatially Enabled Government in Canberra in 2007. The conference highlighted the importance of SEG for Australia. In a country with federal system such as Australia, each state has a different approach in managing and developing spatial information. The Departments of Land in each state have developed various web based spatial information systems for the provision of land and planning information. In the State of Victoria, information on spatial plans is available at <http://services.land.vic.gov.au/landchannel/jsp/map/PlanningMapsIntro.jsp>. This portal provides information on planning scheme maps (including historical archives dating back to 1954), planning zones and overlays, and aerial imagery. Users can prepare and print a customized report in PDF format. Another example from Australia is that of the State of New South Wales available at <https://six.lands.nsw.gov.au/wps/portal/>. This portal has five main functionalities: View, Search, Explore, Connect and Support. Users can view spatial information held in this portal including property, cadastral, topographic map, as well as satellite and aerial imagery. Online search capabilities enable users to look for information on land titles, valuation and spatial plans.

In Asia, South Korea has also moved toward SEG, but is using a different pathway. South Korea is currently pioneering a ubiquitous city (ubi-city in short), a city equipped with large number of sensors to facilitate a ubiquitous computing mechanism. Songdo City is the largest proof-of-concept model of the applicability of the ubi-city. Different types of sensors were embedded in houses, hospitals, road network infrastructures, and business premises (*New York Times, 2005*). All of these sensors are inter-connected, with the location as one of the key important elements. Therefore, the ubi-city in South Korea is also facilitating spatial enablement of government and society.

2.3. National Practice

Internationally, some countries have implemented the SEG concept in real world applications. Examples presented above show the correlation between the e-readiness index or e-Government readiness index and the implementation of SEG. Naturally, SEG needs good internet infrastructure as a medium for its operation. According to The Economist and UN-PAN, Indonesia was ranked as number 68 (out of 70 countries) and 106 (out of 189 countries), respectively. Although Indonesia has improved in the absolute index value in the UN-PAN survey, from 0.3819 in 2005 to 0.4207 in 2008, it seems that other countries have greater improvement. This situation is reflected by higher rank in 2005 (96) compare to 2008 (106). However, within this constraint, some projects on the use of internet for spatial information dissemination have been started. It should be noted that the use of the internet is not the only element of SEG, although a very important one.

Several portals and websites of government agencies at national and local level have already developed web-based information systems for spatial information dissemination. At the national level, Bakosurtanal <http://www.bakosurtanal.go.id> and BPN <http://map.bpn.go.id/> have developed web-GIS for visualization and dissemination of spatial data under their responsibility. Bakosurtanal provide online maps on the following themes: national spatial information system (SISN), clearinghouse, food security, multi hazards, and road network on Java Island and marine resources. Other than that, Bakosurtanal also provide topographic maps at scale 1:1.000.000 freely downloadable. During disaster event, Bakosurtanal delivers large scale maps using the internet, to support emergency response and reconstruction.

BPN has developed an online map with the following categories: vector map, raster map, administrative map, national control network, land transactions and parcel. A screenshoot of this classification is shown in Figure 3. Three vector map categories are available: basic land registration, land registration, and land use planning maps. The land transaction menu is useful to find information regarding land parcel transactions in a particular district. Although the designated large scale map is absent, and its current coverage is limited area, this tool holds interesting potential.

Figure 3. Facilities on the BPN online map.

In relation to spatial planning, the website of the Directorate of Spatial Planning, Department of Public Work <http://www.penataanruang.net> received recognition as the best webGIS from Bakosurtanal. It has comprehensive information regarding spatial planning, from laws and regulations to webGIS of spatial planning at the national, provincial, island and strategic levels.

At the local government level, as of November 2008, there were 12 internet GIS site developed by local governments (Sutanta, 2008). They were located in Nangroe Aceh Darussalam (1), Kepulauan Riau (1), Jawa Barat (2), Jawa Timur (2), Bali (2), Kalimantan Timur (1), Sulawesi Utara (1), Maluku (1) and Papua Barat (1). Figure 4 shows the webGIS of the Sabang city, Nangroe Aceh Darussalam <http://webgis.sabangkota.go.id/dataspasial.html>. This site was developed in 2004, in cooperation with the Agency for the Assessment and Application of Technology (BPPT). It is perhaps one of the earliest webGIS sites owned by local government. Although some local governments have initiated a program to visualize and disseminate spatial information through the internet, the proportion is still low.

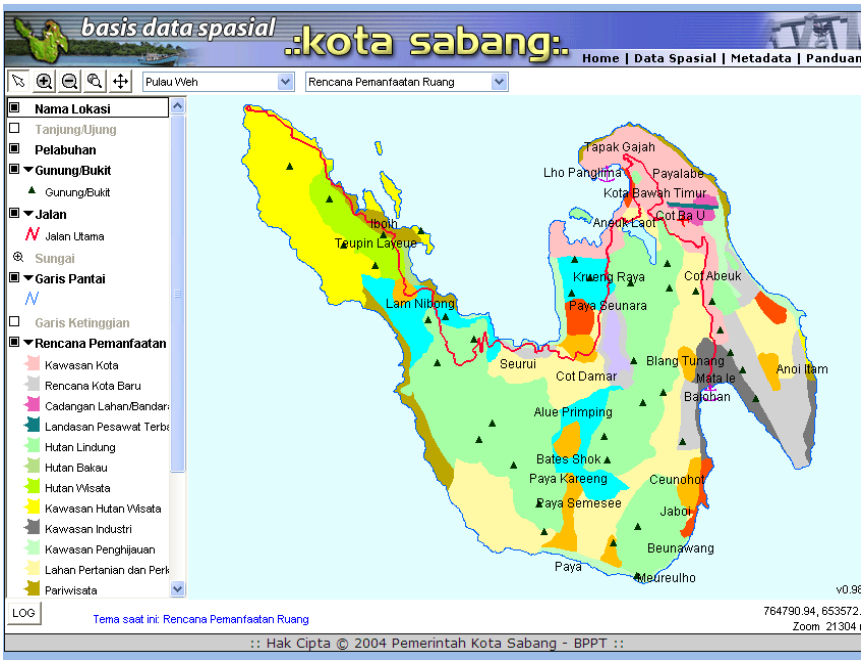

Figure 4. Screen shoot of webGIS of Sabang city.

2.4. National Significance

The use and importance of having spatial information freely accessible by the general public have been presented in the preceding sections. The term freely accessible does not necessarily mean free of cost to obtain data. Spatial data production and maintenance requires expensive investment, which can support the argument for a cost recovery model. Users should contribute to the production cost, or at least pay some contribution to the data distribution expenses. However, citizens and business should have free access to determine the type of spatial information held by the government agencies which may be importance for them. There are some sectors that can take advantages from the SEG, such as spatial planning, disaster mitigation, environmental sustainability, climate change, and national security. All of these sectors have one common element, location, which be presented in as spatial information. This situation will have a multiplication effect on the attainability of SEG objectives. *Massers et al.*, (2008) identify three broad objectives of SEG:

a. More effective and more transparent coordination.
b. The creation of economic wealth
c. The maintenance of environmental sustainability.

Transparency and effectiveness of the government action is becoming more and more urgent. Government decision should be available publicly to its citizens. SEG can facilitate dissemination of the government decision which has spatial footprints. Internet delivery can increase effectiveness because it can reach wider audience with minimum cost. It is also transparent, everyone can see and examine. One example is in the spatial planning sector.

Spatial planning deals with the allocation of a portion of land for specific or multifunctional use. Population growth and demand from economic development has created pressure to limitedly available space. Spatial planning has to take into account many competing requirements in the scarcity of land. Law on Spatial Planning (26/2007) mandates that the general public should be consulted in the process of developing spatial plan and spatial

planning information should be disseminated to them. Spatial planning regulation and maps are better disseminated through internet in the SEG framework, which will enable transparency, greater public participation and reach wider audiences.

Disaster mitigation is an activity focusing on the reduction of the potential casualties and losses when a disaster occurs. It is a multidisciplinary and multiagency effort, requiring collaboration across them. As suggested by NRC (2007), spatial information can play an important role in this process. Again, dissemination of information on hazard prone area and vulnerability maps can be facilitated in SEG.

In the environmental sector, for example, Kalimantan and Sumatra have vast natural resources, from coal to timber. Each of them is managed by different departments and levels of government. Forest resources are managed by the Department of Forestry, mining permit issued by the Department of Energy and Mineral Resources, and local government. It is frequently published in newspapers and magazines that many permits issued by different government agencies are overlapping. This creates legal disputes and uncertainty in the investment environment leading to higher economic costs. Possible sources of this problem are different map projection systems and a lack of standards in spatial data accuracy, with no common framework for working with spatial data. Lack of transparency and certainty on the spatial extent of the issued permit may also be another factor. SEG can provide a platform for preventing this situation arising. Provision of natural resources and conservation zone information on the web transparently will benefit environmental sustainability, since more parties can participate in their monitoring. These are only a small number of examples of the benefits of SEG.

3. Building the SEG in Local Government

Building SEG requires reengineering government business processes and activities. Traditional methods in using, managing and delivering spatial information must be adjusted to match the current innovation in information and communication technology. It is also important to find the most effective way of finding and relating footprints of non-spatial information to spatial data. On the organizational aspects, developing new unit or re-focusing existing structures are likely to be required. However, developing new organization may not be a preferred choice because it will create other bureaucratic problems. Identification of current stakeholders, organizational structures, practices and infrastructures are also important. In this section, three aspects will be discussed in detail: stakeholders, spatial dataset, and role of local government.

3.1. Stakeholders

SEG requires expertise from various disciplines, such as geo-information, ICT, management, law and public administration. It requires active participation, close cooperation and involvement from different stakeholders. Cooperation and collaboration among government agencies, at both national and local level, are the nerve of the implementation.

At the national level, there are some government agencies whose daily activities involve working with spatial data, for example Bakosurtanal, BPN and Department of Forestry. Bakosurtanal has a mandate to develop the required spatial data, basic and thematic, for other government agencies. However, there is still a lack of coordination among government agencies, because there is no law regarding who has the responsibility and authority in

managing spatial information. The Law on Geo-spatial Information is scheduled to be discussed in the parliament by this year, with the best estimate being that it will be enacted by the end of 2010. This law will provide a foundation for better management and handling of spatial information at national and local levels.

At the local level, the main agencies using spatial data extensively are the local planning agency (BAPPEDA) and the Agency for City Planning and Housing (Dinas Tata Kota dan Permukiman – DTKP). BAPPEDA has a role managing spatial information with regard to spatial planning, infrastructures and land use. DTKP activities are mainly on the managing and issuing of building permits to comply with the spatial plan and building codes. Other government agencies, whose activities involving spatial information, are Public Work, Energy and Mineral Resources, Agriculture and Forestry, and Health. These agencies are using spatial information as support data for their main activities. BPN has office in all cities and districts but report to their national office. Spatial data produced and managed by BPN actually plays an important role in SEG. However, current practices indicate that data sharing between local and national government agencies seemed not to work very well and need to be enhanced.

Among the local government agencies, BAPPEDA is the one who might has the minimum required capacity to deliver essential services of spatial information as part of SEG. It has the capacity to coordinate other government agencies. In relation to Perpres 85/2007 on the National Spatial Data Infrastructures (NSDI), it is highly likely that BAPPEDA will be appointed as the local spatial data clearing house.

Participation from the private sectors is also required. The private sector includes those who production spatial information, mainly for the government, although they may also be working on their own initiative. The private sector is also use spatial data produced by the government, creating value-added product and then sell it to the government and the public. Three main organizations of the mapping community are the Indonesian Surveyor Association (ISI), the Surveying and Mapping Company Association (APSPI) and the Indonesian Community of Remote Sensing (MAPIN). Member of ISI and MAPIN are mostly from government agencies and academics, and therefore private sector involvement in organization decision still marginal. APSPI activities in policy making campaign is also limited. These bodies need to be encouraged to actively participate in SEG development.

3.2. Spatial Dataset

Spatial data are the backbone whereby other information will be spatially referenced. Therefore, developing and maintaining appropriate datasets is important. Generally two types of spatial datasets are used, fundamental and derived. Fundamental datasets are defined as data that can not be derived from other data (WALIS, 2010). These will serve as base for other data or to develop derived product. There are some variations in defining what constitutes fundamental datasets. Here, fundamental dataset should consist of the following types:

a. Geodetic network. A set of horizontal and vertical control point defined in a specific datum to cover the whole country and is used as a reference frame for mapping activities. Indonesia use the national geodetic datum (DGN: Datum Geodesi Nasional) 1995, which use the similar reference system as GPS. It is made up from zero, first, second, third and fourth order national horizontal control networks. The realization of zero and first order network are the responsibility of Bakosurtanal, while the second

to fourth order are of BPN. They should be used in all mapping activities to ensure coherence that is datum similarity and maintaining spatial data integrity.

b. Topographic map. This covers all natural and man-made features of the earth surface. Contour lines are used to visualize terrain relief. Water body, road network and geographic names are all integral part of the map. The map can be used as base data to create many thematic maps, such as land cover, land use, population and hazard maps.
c. Cadastre and land titles. Cadastre is a comprehensive register of land parcel, including the boundary, owner, and associated rights. Right, Restrictions and Responsibilities (RRR) associated with a particular land parcel need to be defined clearly in digital cadastral database
d. Street address and toponym databases. Common use of standardized street address databases by different local agencies is essential to endorse effective public services in social and economic sectors including property, retails, and social safety network for cash program from the central government (Bantuan Langsung Tunai – BLT). Accurate place names in terms of their position geometry and attributes are also required for spatial planning and natural resources management. Street address and toponym databases can be generated as information services for location-based services, topographic mapping, and fiscal cadastre
e. Aerial photography and satellite imagery. They give synoptic view of the earth surface at the time of image acquisition. They are the basic data required to produce topographic and thematic maps at various scale.
f. Administrative boundary. Administrative boundary is important in the determination of who has the right to manage and govern a particular area. Therefore, clear and definitive boundaries between two adjacent districts/cities is needed. Boundary disputes occur in many districts/cities, such as between District of Kediri and Blitar regarding Mt. Kelud (*Tempo*, 2008) and between Sleman and Bantul concerning Banguntapan village (*Jawapos*, 2009).

Most of the fundamental datasets are produced by the national government agencies, while the local governments are merely consumers. Table 1 shows some of the producers and users of spatial data. Some projects at the local government are actually related to the production of spatial data, for example aerial mapping project to develop basic map for spatial planning. Lack of coordination among government agencies sometimes leads to duplication of effort, or worse omission of important features. The contribution of local government is minor in producing fundamental datasets. They still depend on national government in obtaining the necessary fundamental datasets.

Table 1. Producers and users of spatial data

Producer of Basic Data Set	User	Producer and User
• National Coordination Agency for Surveys and Mapping (Bakosurtanal) • National Land Agency (BPN)	• Local Planning Agency • Department of Health • National Agency for Disaster Mitigation • Utility sector (electricity, water, telecommunication) • Department of Public Work	• National Coordination Agency for Surveys and Mapping (Bakosurtanal) • National Land Agency (BPN) • Department of Forestry • Department of Energy and Mineral Resources • Department of Agriculture • Bureau of Statistics

Spatial information creation is expensive, and therefore should be planned carefully to obtain its maximum benefit. However, once it is created, it is virtually cost-free to reproduce. In this

regard, a business process model in how to recover cost of production should be developed, which include licensing method. Fundamental dataset should be easily accessible and affordable, encouraging private sector to innovate in value-added product. In simplified model, revenues from tax of the creation of value-added product might be higher than the cost in the production of fundamental dataset. To achieve this model, it is required that copyright should be honored.

3.3. Role of Local Government

Government is responsible for the most part, if not all, of the SEG design and implementation. Although decentralization has been initiated and implemented for quite some time, the role of central government in the spatial information sector is still more dominant compare to the local government. Central government has more skilled staff, funding, knowledge and better vision compared to local government. Not every local planning agency or local government in districts/cites has staff capable operating GIS and maintaining spatial information. Within this context, central government has a fundamental role in defining the vision, develop regulatory framework, lay of foundation, and initiating activities and the provision of funding.

Vision on what would the SEG looks like and what the necessary conditions are to be met should be defined clearly by the central government, possibly by presidential decree. Precedent from e-government initiative, which was based on presidential directive number 3/2003 on e-government, can be followed up with other regulation. One important progress is the presidential regulation on the National Spatial Data Infrastructure (Perpres 85/2007). It ordered the development of spatial data nodes in each districts as a point of contact for data sharing and dissemination. At the higher level, submission of the draft of the law on Geospatial Information to the parliament is also another significant progress after the years.

The newly enacted regulations and submission of the draft are expected to overcome the deficiencies. Existing laws and regulations do not clearly specify what the role of local government on spatial information management. For example, according to law 32/2004 on Local Government, local government has, amongst other, rights on:

- Planning, utilization and monitoring of spatial planning.
- Land administration.

These two rights are closely related to, and make extensive use of, spatial information. On the first aspect, the local government has the required capacity in fulfilling these tasks, because they have been conducting them for several decades. The latter case is still under debate whether local government has the capacity to deliver or not. Some proponents argue that land administration should be managed centrally to maintain the national integrity. Ideally, there is a local government agency appointed as custodian of spatial information. This agency, presumably BAPPEDA, will act as the data centre and clearing house. It will collect spatial metadata from other government agencies, develop a repository centre and spatial data infrastructure. Creating a new agency will only increase the size of the bureaucracy, thus reducing efficiency.

Williamson *et al* (2007) proposed a toolbox approach for the development of SEG. A toolbox approach means identifying, describing and developing the necessary tools and components to achieve the objectives. It consists of two main tools: institutional and framework, and technical tools. Institutional and framework tools consist of the following components:

a. Institutional framework to establish legal framework and suitable organizational structures for spatially enable government and inviting innovation from private sector.
b. Policy on spatial enablement at the central and local government level. National policy should serves as an umbrella, as well as provides directive and guidance on, among other thing, cross-jurisdictional cooperation. Local government policy should focuses on local characteristics and requirements, mostly related to technical implementation.
c. Business models for use of 'space' to organize information, services and activities. Creation and re-engineering business model are required to deliver interoperable government through web enabled and interactive systems.
d. Monitoring and evaluation process, similar to other initiatives, in terms of fiscal and non-fiscal measurable.

The technical tools consists of

a. iLand - a spatial information availability platform. It deals with the transformation of all information system, especially land and property database, to embrace opportunities in spatial enablement. It is also about promoting innovation throughout government, business and public.
b. Spatially enabled cadastre. Highly accurate cadastre map is fundamental in developing authoritative spatial register and should be used by all government agencies in all jurisdictions.
c. SDI for the interoperability and accessibility of spatial information. It consists of technical solutions, business process model and national compliance.

4. Challenges and Opportunities

Implementing new concepts in new environments poses many challenges and opportunities. The challenges may even be bigger considering the large disparity in local government capacity. Fortunately, there are opportunities from external environment and internal government.

4.1. Challenges

Implementing SEG is not an easy task, faces challenges from internal and external factors. The following is a list of challenges, partially taken from Kok et al. (2007): internet penetration, limited user, institutional condition, human resources, access issue, information policy, standard, IT infrastructure, software and licensing.

The internet penetration is a measure of the proportion of a community who has access to the internet. According to the Indonesian Association of Internet Service Provider - APJII (2008), internet user in 2008 was estimated to be approximately 25 million people, approximately 10% of the total population. This figure will be highly likely to increase by the recent development in relatively low cost broadband network and popularity of social networking sites. Latest estimate from the Internet World Stats shows indicates that, as of September 2009, there were approximately 30 million internet users in Indonesia (Internet World Stats, 2010). However, this figure still represents relatively small proportion of the population, approximately 12.5%. Internet users can be classified in three age groups, 14-25, 26-35, 36-

45 years old. Majority of them has bachelor or high school education. This critical mass of users will continuously to increase every year, which has positive impact on the SEG. Another aspect is digital divide among districts/cities. In the big and well developed cities, there is good internet access. But in the remote districts and sub-districts, there are few internet connection and internet kiosks. Low internet penetration has a correlation to the limited number of users of spatial information available online from the government.

Small user's numbers can be result from two reciprocal factors, just like the old problem of the chicken and the egg. Spatial information available from local government websites is limited with infrequent updating. Based on the internet survey conducted in October-November 2008, it was found that only 212 of the districts / cities have maps on their websites. Furthermore, only 12 districts / cities have developed internet GIS application, and 9 districts / cities make use of the Google Maps customization facility (Sutanta, 2008). On the other hand, there are only a small numbers of users who access or require access to spatial information from local government websites. This situation may be linked to low requirements to conduct internet based transaction over spatial information.

There are two issues are affecting institutional aspect, internally and externally among government agencies. A survey on spatial planning and spatial data infrastructure has been conducted in 2009 with respondents from 23 local planning agencies. The results reveal that only small portions (30%) of respondents indicated that they have set up a GIS unit. In the SEG context, GIS unit can be regarded as a pilot for more developed SEG implementation. Discussion with some respondents indicated that a directive from the central government is required to set up this type of unit. Internally, developing a GIS unit and product was largely dependent on the creativity of technical staffs. Institutional cooperation was mostly based on 'gentlemen's' agreements' among staff in organizations involved in *ad hoc* project, with only a small number of formal agreement was in place. Difficulties sometimes hampered cooperation and collaboration between local and central government agencies.

SEG requires expertise from various disciplines including, but not limited to, geo-information science, IT, public administration and economics. However, from the conclusions of Sutanta *et al.* (2010) shows that in the local planning agency there is a lack of staff with backgrounds in geo-information science. The proportion of staff with this background was limited in the respondents' organization. Some local planning agencies even do not have staff with these qualifications. Staffs with other required backgrounds were also not available in all local planning agencies. Access issues define what, and when certain, type of data can be made publicly available. In general almost all spatial information held by government agencies is in public domain section. However, there are privacy issues of individuals and government that should be respected as well as copyright to be honored.

A standard is required to enable all stakeholders using and accessing reliable data and information in an agreed specification. Example of technical standards is map projections, scale and cartographic standardization on map symbols. Differences in standards can create different interpretations of similar features and thus reduce interoperability. The Indonesian National Standard (SNI) for spatial data should be adopted at all levels of governments, not only internally at Bakosurtanal. If, in some cases, the standards do not exist yet, it should be developed. Perpres 85/2007 instructed that if SNI does not exist, specification from the National Spatial Data Network should be used temporarily.

IT infrastructure is one of the important physical components of SEG. Many local planning agencies, which are most likely to be the agency in charge of the implementation, have inadequate IT infrastructure. Out of 34 respondents participated in the survey conducted in 2009, only 50% of them stated that their IT infrastructure was adequate/good/very good. The rest of them felt that they are using bad or very bad IT infrastructure.

Software and licensing is another of major issue. Funding to buy proprietary software can be a source of major difficulties in developing SEG capacity in local government. Large financial sums are required to be allocated if the local governments wish to use sophisticated proprietary software. Alternatively, they can use open source software, but it will depends on their internal capacity. Use of open source software may overcome funding problem, but the learning curve is steep and technical support is limitedly available.

4.2. Opportunities

Despite some challenges described in the previous section, SEG can still be implemented in local government. However, using an optimistic perspective, it cannot be realized in the near future. A moderate estimate of the starting point is five years from now, considering existing policy, institutional capacity, human resources, funding and internet penetration. External and internal factors will influence the deployment time of SEG: availability of fundamental datasets, lower costs for high resolution satellite imagery, availability of free and open source software, internet penetration, quality improvement in human resources, and critical mass an educated young generation.

Fundamental datasets are increasingly available and accessible from several Bakosurtanal outlets in many provinces. They have wider coverage and larger scale. Cadastral information is also more accessible at local land offices. What is left behind is street address and toponyms database, which should get high priority from the national and local government. High resolution satellite imageries are becoming cheaper and easier to obtain and will benefit to the development of thematic spatial databases. Free and open source software for offline and online processing of spatial data are currently abundant. Newly recruited technical staffs at the local government are usually eager to learn new technology, receptive to new innovation and organizational changes. This condition is also true for the critical mass of young generations who are aware of the potential and power of internet, and are growing fast.

There are two main aspects which will influence internet penetration in urban and rural areas, cost and infrastructure. According to the press release from the Department of Communication and Information, in March 2008, internet users, typically will have to pay from Rp. 57/minute (speedy) to Rp. 350/Mbyte (ADSL Telkomsel), and Rp. 600/Mbyte (broadband). Accessing internet in internet kiosk or cybercafé cost around Rp. 3,000 to Rp. 10.000 per hour (KOMINFO, 2008). The cost is likely to remain the same or even slightly reduced, but the quality is improving.

In terms of the way users accessing the internet, internet kiosks were still dominate. According to Iskandar (2007b), internet kiosks contributes to 43% of the users, followed by offices (41%), households (12%), universities (3%), and schools (1%). Broadband users in June 2009 were approximately 294.000 (Internet World Stats, 2010). The development of the Palapa Ring Project will speed up the process of distributing high speed internet through fiber optic to all districts and cities. By the completion of the project, there will be additional 320 Gbps of bandwidth available. As of December 2007, Indonesia has 80 Gbps and 5 Gbps of domestic and international bandwidth respectively. Some of the project's aims are to reduce

the digital divide between societies and to support business competitiveness in under-developed region. It was also aimed to provide more efficient and far reaching communication infrastructures to public and government sectors (Iskandar, 2007a). The completion of the Palapa Ring project will give a strong foundation to e-government program in general, and spatially enable government initiative in particular.

All of these driving factors need to be complemented by consistent policy, capacity building and partnership. Central government policies are required to provide directives and guidance to local government. They are needed to provide common framework and create interoperable systems across organizations at, and between, all levels of government. Capacity in the organization in charge as well as participating agencies needs to be improved to meet minimum requirements to deliver SEG initiatives. Partnership is a critical element in ensuring smooth and continuous day to day implementation of SEG. A formal arrangement, perhaps based on central government regulation, need to be establish.

6. Lessons-learned

Spatially enabled government is a promising approach to support integrated and sustainable development of the country. However, SEG is not just about implementing web mapping technology and enabling community participation. It is more than that. Rather than fully adopting other approaches, investigation should be furthered on to find an appropriate model of SEG that fits for national community purposes. Some technical investigation should include:

a. The definition of roles of local government in managing spatially referenced public records (e.g. building register, house addresses) and official spatial data as the ongoing decentralization processes still left some unsolved problems such as land management and natural resources management.
b. The national mechanism to integrate islands of SEGs at local levels. This can be a complex phenomenon as every local government initiates their efforts in building spatial database and portals with no clear guidance on the interoperability requirements from national authorities to ensure effective data integration and synthesis.
c. An innovative technique to raise awareness for SEG and subsequently to enable local authorities to develop their own capacity to implement SEGs. For this purposes, a generic tool that include pre package spatial data templates and their data interoperability tools can be developed first based on needs and requirements in managing local spatial data

7. Conclusions

Spatially Enable Government is an important component of e-Government initiatives to bring more effective, transparent and accountable governance of both spatially and non-spatially related activities. It will also increase public participation and engagement, enable better informed decision-making and democracy. Implementation of SEG depends on internal and external factors. Internal factors include appropriate policy, institutional capacity and arrangement, human resources and funding. Two main external factors are internet penetration and a critical mass of users.

Observations on current use of official websites reveal that local government is still far from ready to implement SEG. Most of the websites offer little spatial information content, even only document on the relevant regulation. The digital divide currently existing among local government makes the less digitally aware of them will be left behind. SEG can be implemented in local government as long as there is leadership from the national government, increasing internet penetration into remote areas, and capacity building initiatives. Considering the current situation, it is likely that SEG cannot be implemented in Indonesian local government in the near future.

However, considering the importance and significance of spatially enable government in the sustainable development, it is essential that the government should start to develop the necessary policies. It is mainly the responsibility of the central government, to provide consistent and interoperable system throughout the country. As the local government will be the spear heads in its implementation, attention should be put to overcome deficiencies encountered on them. Building local government capacity in handling spatial information is indispensable. It should include aspects of human resources capability, both at technical and management level, funding and institutional arrangement. On the external factor, the central government should increase internet penetration and its coverage. The Palapa Ring projects will likely fulfill this expectation. Cooperation between different government agencies as well as with private sector and public will keep the SEG's prospects in the Indonesian local government.

References

Aditya, T. (2009). Perencanaan dan Penyelesaian Masalah InfrastrukturPerkotaan Melalui Integrasi SIG Kolaboratif dan SIG Partisipasi Publik. Geomatika, 15(1), 1-20.

Arsana, I M.A., Sutanta, H., Muryamto, R., and Rumono, B. K., (2006). *P*arcel-based mapping for Building Damage in the Aftermath of the Yogyakarta - Central Java Earthquake on 27th May 2006: A Case study of Purbayan Village in Kotagede, Yogyakarta, Proceeding in Indonesia Geospatial Technology Exhibition 2006, Jakarta, Indonesia, 23 August 2006.

APJII, (2008). *Statistik APJII Updated Desember 2007*, Retrieved 28 November 2008 from http://www.apjii.or.id/.

Department of Economic and Social Affairs (DESA). (2008). *United Nations e-Government Survey 2008, from e-Government to Connected Government*. United Nations, New York, 2008.

Georgiadou, Y., Stoter, J. (2010). Studying the use of geo-information in government – a conceptual approach. *Computers, Environment and Urban System* 34(1), pp. 70-78.

GSDI. (2009). Spatial Data Infrastructures Cookbook 2009. Global Spatial Data Infrastructure.

Holland, P. (2009). Understanding Spatial Enablement of Government. *Proceedings of the Surveying & Spatial Science Institute Biennial International Conference*, Adelaide, 2009.

Internet World Stats. (2010). Internet World Statistics: Asia. Accessed from http://www.internetworldstats.com/asia.htm#id on 12 March 2010.

Iskandar, B.Y., (2007a). Indonesia's Initiative to Deploy NGN, *7th Global Symposium Regulator 2007, The Road to Next-Generation Networks (NGN): Can Regulators Promote Investment and Open Access?*, Dubai, United Arab Emirates - 5-7 February 2007.

Iskandar, B.Y., (2007b). Perkembangan Telekomunikasi Indonesia. *Seminar Nasional Pengelolaan di Bidang Energi dan Kelistrikan serta Teknologi Informasi Komunikasi Nasional.* Yogyakarta, 5 December 2007.

Jawapos, (2009). Warga Banguntapan Tetap Tenang Pasca Mencuatkan Sengketa Perbatasan, Retrieved 31 January 2010 from: http://www.jawapos.co.id/radar/index.php?act=detail&rid=109198, accessed on 31

Kok, B., Rajabifard, A. , Williamson, I.P. (2008). Spatial Enablement of Government and NSDI – policy implications. Proceedings of the 10th GSDI Conference. 26-29 February, Trinidad.

KOMINFO. (2008). Jaminan Kepastian Publik Untuk Berselancar Di Internet Dengan Tarif Yang Jauh Lebih Murah. Press release No. 35/DJPT.1/KOMINFO/4/2008. Accessed on 12 March 2010 from http://www.postel.go.id/update/ id/baca_info.asp?id_info=949.

McDougall, K. and Rajabifard, A. and Williamson, I. P., (2005). What will Motivate Local Government to Share Spatial Information?, in *Proceedings of SSC 2005 Spatial Intelligence, Innovation and Praxis*: The national biennial Conference of the Spatial Sciences Institute, Melbourne Convention Centre.

Masser, I., Rajabifard., A., Williamson, I. (2008). Spatially Enable Government through SDI Implementation. International Journal of Geographic Information Science, 22(1).

NRC. (2007). Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management, National Research Council.

O'Looney, J. (2000). *Beyond Maps: GIS and Decision Making in Local Government*, ESRI Press.

Rajabifard, A. (2008). Re-engineering SDI design to support Spatially Enabled Society and Government. INSPIRE Conference 2008, Implementation and Beyond, Slovenia, 23-25 June 2008.

Sutanta, H. (2008). *An Evaluation on the Use of Internet for Spatial Data Dissemination in Indonesian Local Government Websites*, Jurnal Ilmiah Geomatika Vol. 14 No. 2, December 2008.

Sutanta, H., Rajabifard, A., Bishop, I., (2010). Impediments in e-Planning in Indonesian Local Government. *Accepted paper for FIG International Conference*, Sydney 11-16 April 2010.

Tempo. (2009). Sengketa Gunung Kelud, Gubernur Jawa Timur Tak Bisa Sembarangan, Retrieved on 31 January 2010 from http://www.tempointeraktif.com/hg/ nusa/2008/11/26/brk,20081126-148228,id.html.

The Economist, (2009). E-*readiness rankings 2009, The usage imperative: A report from the Economist Intelligence Unit*. The Economist.

The New York Times. (2005). Korea's High-Tech Utopia, Where Everything Is Observed, Accessed on 10 February 2010 from: http://www.nytimes.com/2005/10/05/technology/techspecial/05oconnell.html?ex=1 286164800&en=4a368c49e8f30bd2&ei=5088,.

WALIS. (2010). Fundamental Dataset. Accessed from http://www.landgate.wa.gov.au. Accessed on 31 January 2010.

Williamson, I.P., Rajabifard, A., Wallace, J. (2007a). Spatially Enabled Government – An International Challenge. *Proceeding International Workshop on Spatial Enablement of Government and NSDI – policy implications*, Seoul 12 June 2007.

Williamson, I.P., Rajabifard, A., Binns, A., (2007b). The Role of Spatial Data Infrastructures in Establishing an Enabling Platform for Decision Making in Australia. In H. Onsrud (ed.) *Research and Theory in Advancing Spatial Data Infrastructure Concepts* (pp: 121-132). Redlands, CA: ESRI Press

Contributors

Heri Sutanta is currently a PhD student at the Centre for Spatial Data Infrastructures and Land Administration, Department of Geomatics, University of Melbourne. He works as lecturer at the Department of Geodesy and Geomatics Engineering, University Gadjah Mada since 2002. His research interests are on the integration between spatial planning, geographic information system and disaster risk reduction.

Dr Abbas Rajabifard is an Associate Professor and Director of the Centre for Spatial Data Infrastructures and Land Administration at the Department of Geomatics, the University of Melbourne. He is President of the GSDI Association, and a member of Victorian Spatial Council. He had published broadly on SDI, land administration, GIS and spatial data management.

Dr. Trias Aditya is a Lecturer at the Department of Geodesy and Geomatics, University Gadjah Mada. He obtained his PhD degree from the University of Utrecht, the Netherlands. His research interests are on spatial data infrastructures, internet GIS, cartography and land administration.

Author/s:
SUTANTA, HERI; RAJABIFARD, ABBAS; Aditya, Trias

Title:
Implementing spatially enabled government (SEG) concept in Indonesian local government, challenges and opportunities

Date:
2010

Citation:
Sutanta, H., Rajabifard, A. & Aditya, T. (2010). Implementing spatially enabled government (SEG) concept in Indonesian local government, challenges and opportunities. In M. S. Zein (Ed.), Contribution matters! Insights of Indonesian students in Australia (chapter 4). Bruce, A.C.T.: Aura.

Publication Status:
Published

Persistent Link:
http://hdl.handle.net/11343/28958

File Description:
Implementing spatially enabled government (SEG) concept in Indonesian local government, challenges and opportunities