

# **Towards democracy in spatial planning through spatial information built by communities: The investigation of spatial information built by citizens from participatory mapping to volunteered geographic information in Indonesia**

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**Abstract.** 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 [1]. 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 [2]. Crowd-sourcing has turned into a 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. Interactive spatial visualization has the possibility to be a useful democratic planning tool to empower citizens participating in spatial data provision and sharing in government programmes. 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 [3][4][5]. In terms of the democratic spatial planning action, Volunteered Geographic Information (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. This paper has aim to investigate 'How is spatial data created by citizens used in Indonesia?' by discussing the characteristics of spatial data usage by citizens to support spatial policy formulation, starting with the history of participatory mapping to current VGI development in Indonesia.

## **1. Introduction**

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 [6]. 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 Volunteered Geographic Information (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 citizens and governments increasingly demand accurate data and information.

Citizens as actors 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 [7].

There have been many studies by GIS and planning scholars of community-based spatial data management and usage for regional planning purposes [8][9][10][11]. 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 [12][13]. This paper has aim to investigate 'How is spatial data created by citizens used in Indonesia?' by discussing the characteristics of spatial data usage by citizens to support spatial policy formulation, starting with the history of participatory mapping to current VGI development in Indonesia.

## **2. Methods**

This research predominantly used qualitative methods with specifically approach was discourse analysis using legal document analysis and in-depth interview to participatory mapping and VGI coordinators. The legal document collections were needed to gain a comprehensive understanding of spatial information built by citizens in spatial planning process. Furthermore, the interviews were used to understand the perspective of the government and planning stakeholders in terms of their current strategy and initiatives for promoting spatial planning process from a political and social background.

An in-depth interview activity is undertaken to get information about the acquainted and substantial spatial information built by citizens the spatial planning process. In this case, the respondents explained their current working activities and experiences using Geographical Information Systems (GIS), including their expectancy and threat towards spatial data sharing amongst institutions. In order to facilitate the process of interview and to ensure all information are secured, note taking with the help of digital voice recording has been applied and later transcribed. Furthermore, the legal document collections were used to serve the purpose of providing a fundamental background of the policy context

to gain a comprehensive understanding of the spatial data development and sharing in spatial planning formulation that has been done and will do in the future.

### 3. Research Results

This section discusses the characteristics and development of spatial data usage by citizens 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 citizens. 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 paper will be discussed after exploring the history of participatory mapping in Indonesia

#### *3.1. Historical background of participatory mapping in Indonesia*

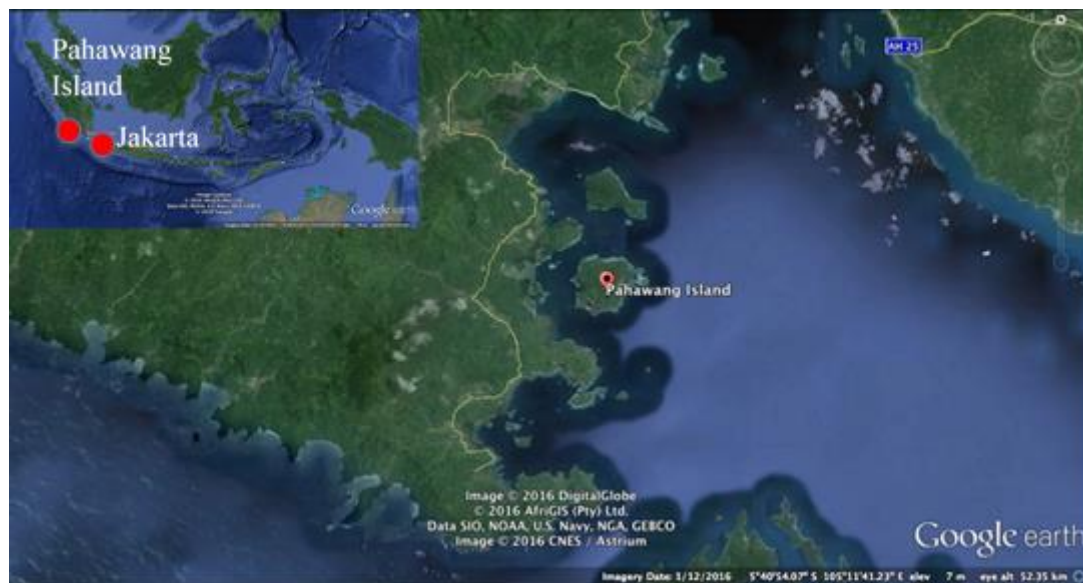
Participatory mapping initiation in Indonesia to be carried out by indigenous people, communities, and the Non-Governmental Organisations (NGOs) for the advocacy in spatial planning for their land when it was proposed for commercial development. Many indigenous people and communities have used participatory 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 citizens participates and engage to keep their claim territories regarding natural resource management through participatory mapping [14]. 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 [14].

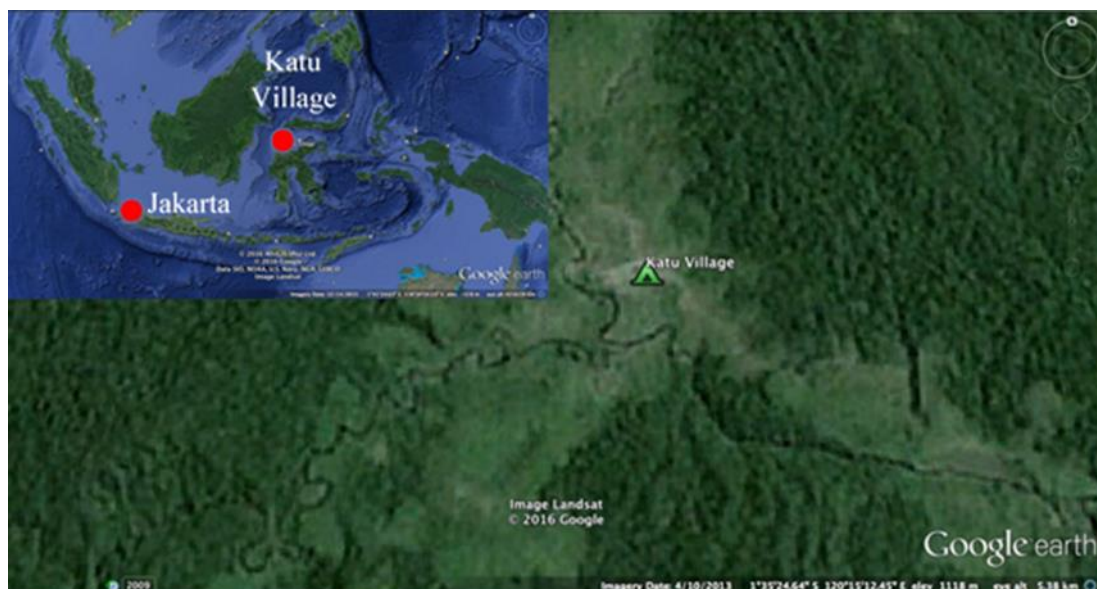
An example of mapping in relation to advocacy zoning mapping can be seen in a case study of participatory mapping on Pahawang Island (See Figure 1). In this area, the local community used the map to build consensus between traditional fishermen and modern fishermen in relation to fishing activity. The 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 [14].

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 [14].



**Figure 1.** Pahawang Island geographical location.

An 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 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) [15].



**Figure 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, economic and cultural aspects [16].



*3.1.1. 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 [16].

*3.1.2. 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 [16].

*3.1.3. 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 [16]. 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.

### *3.2. The Impediments of Participatory Mapping Activities 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. [17]

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 interests. 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 individual's tenures and timber concession to companies issued by the Ministry of Forestry [17].

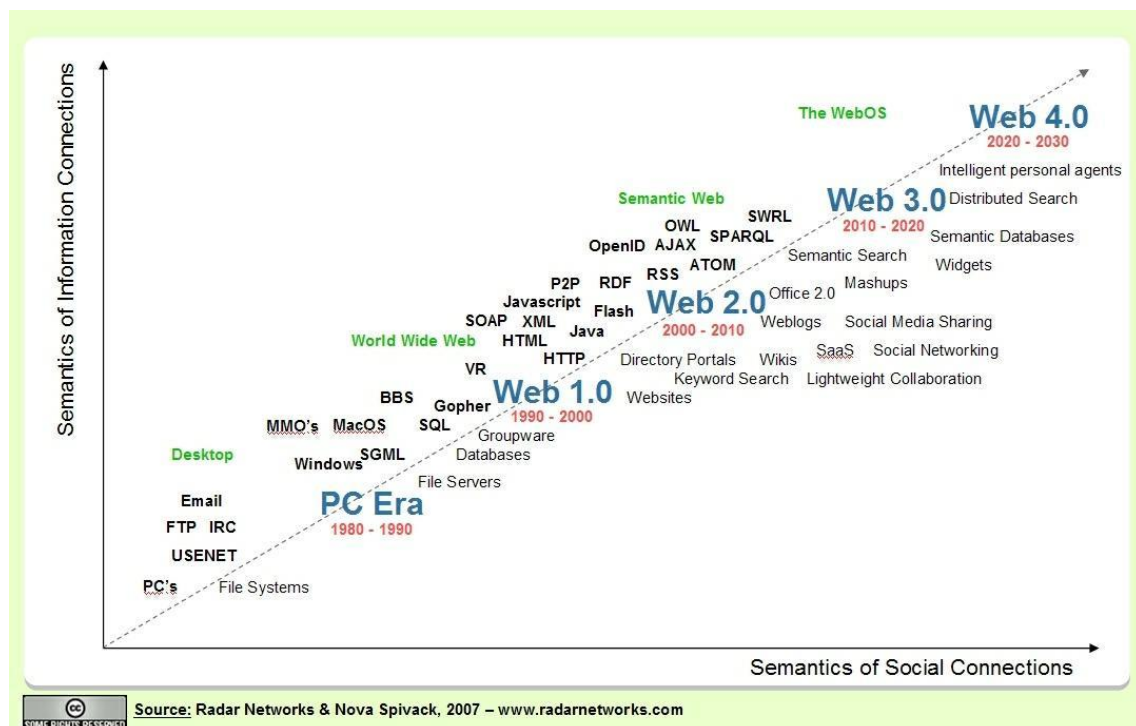
But many forest concessions issued by the Ministry of Forestry were generally located on land that was controlled and managed by indigenous societies who were then able to get bans placed on businesses in areas claimed by timber companies. The situation got worse when the companies claimed land ownership 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 effects 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.

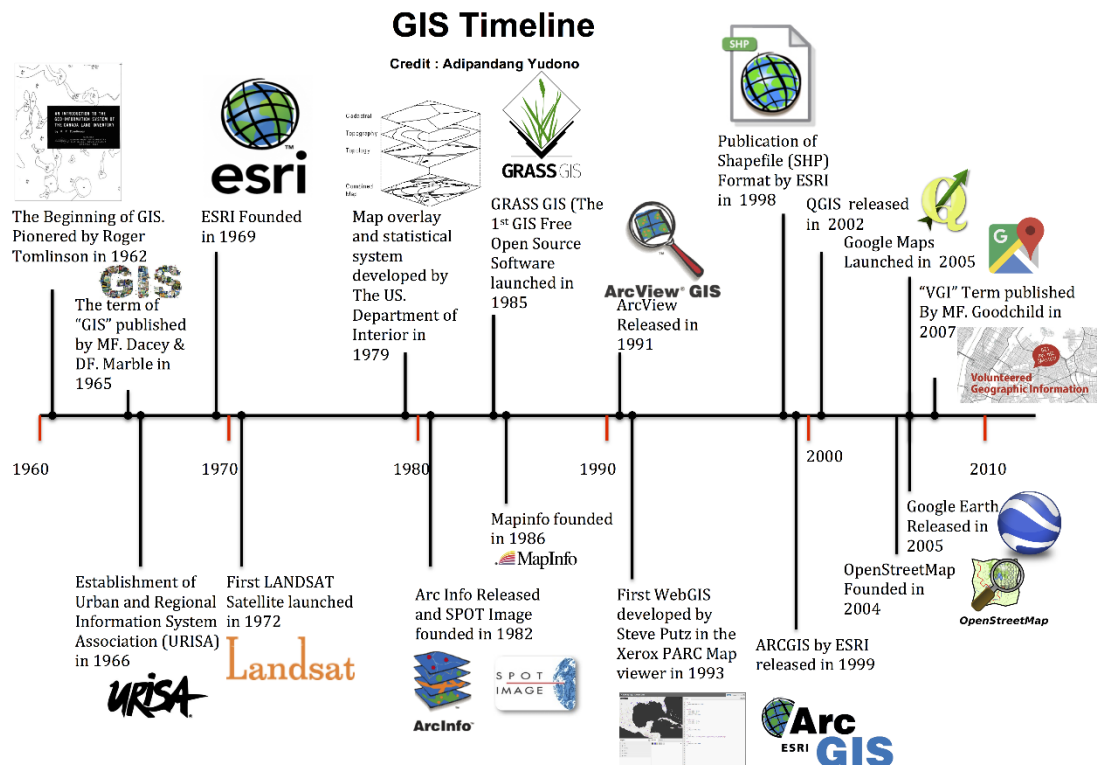
### 3.3. From Participatory Mapping to VGI Activities in Indonesia

Interactive internet usage is growing rapidly with the next-generation 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 can also be involved as a data and information producer and provider (see Figure 3).



**Figure 3.** Internet generation era.

In this context, citizens can create and share spatial data and place their territorial observations on public web mapping application programming interfaces (APIs) such as Google Maps, WikiMapia, OSM and Microsoft's Virtual Earth [3][4][5]. Globally, in the 1990s, spatial data production and provision was dominated by national mapping agencies. However, advances in mapping technology and support of the internet provide GIS open source data for the production and procurement of spatial data or information. Since the 2000s, spatial data providers outside government agencies have been widely established to produce and provide spatial data development and sharing services amongst their communities. The development of GIS from a stand-alone application to crowd-sourced geographic information be seen in Figure 4



**Figure 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 to the public. This data is produced by persons with cartographic expertise and having high quality products. The spatial data generated are encrypted and cannot be re-processed. 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 charge 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.

### 3.4. VGI initiatives in Indonesia

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 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=1Ok41gwEcc0wW0Nu-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 entrepreneurs [18].

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 Australia and the main aim was to carry out natural disaster risk exposure mapping in the eastern Indonesia region (See Figure 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)



**Figure 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. [19]

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.

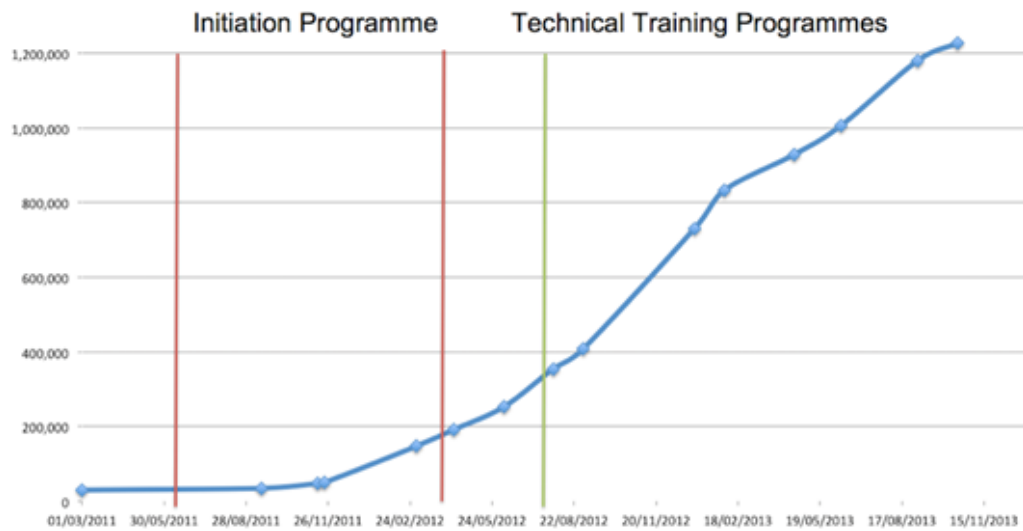
In supporting operationalization in the field, BNPB required spatial information visualisation in large-scale maps (1: 500, 1: 1000; 1: 5000; 1: 10,000). But Badan Informasi Geospasial (BIG), as the official government institution for creating and providing spatial data, could not meet the needs of the 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 [19].

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.

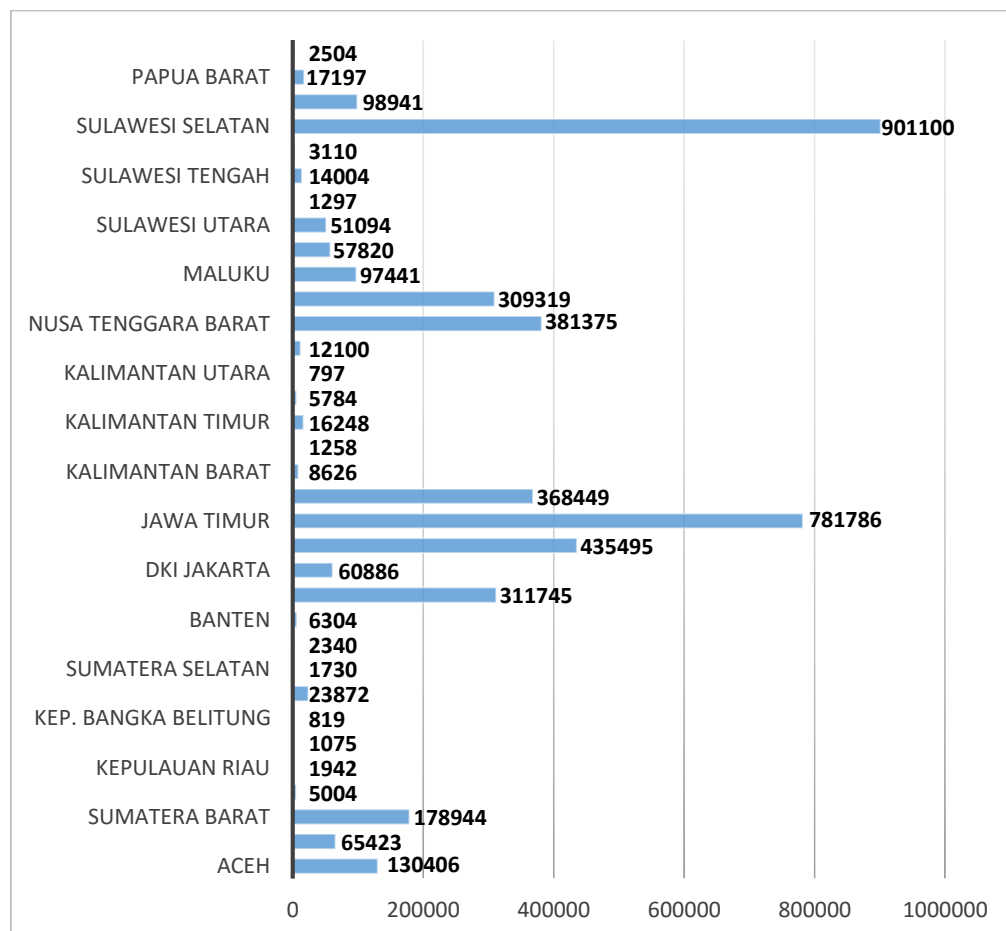
### *3.5. Current VGI Development in Indonesia*

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, then at the beginning of OSM operations (Figure 6). The number of buildings mapped by May 9, 2016 was 4,238,869 (Figure 7)



**Figure 6.** Time series of the number of buildings mapped in Indonesia through the openstreetmap platform.



**Figure 7.** Statistics of the number of buildings mapped in the territory of Indonesia by 9<sup>th</sup> May 2016.

Strategies have been undertaken by HOT Indonesia for training OSM communities, including: basic and advanced training in building geo-databases 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 (Palang Merah Indonesi (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 empowerment. 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.

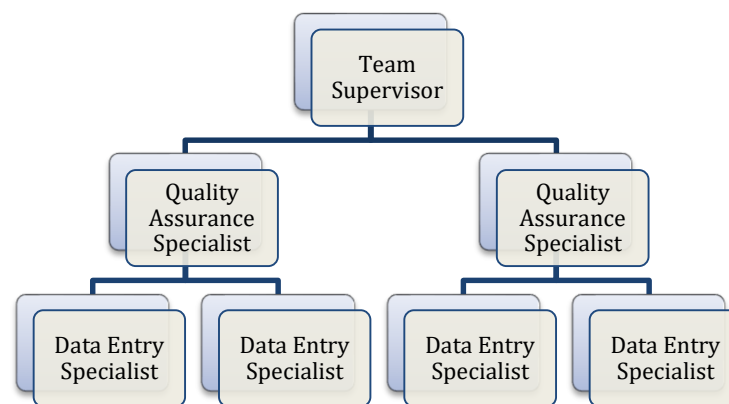
### *3.6. The significant VGI actors to achieve success building interactive digital mapping community empowerment in Indonesia*

The significant VGI contribution to build spatial database in Indonesia is owing to the substantial VGI actors role in encouraging communities to map particular areas on the open source GIS platform. Shkabatur (2014) argues that there are four groups of actors 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[21]. However, drawing on observations, interview and HOT internal reports, the researcher identified five main actors for creating successful VGI activities in Indonesia: international funders; HOT administrators/VGI organisers; local government; local organisation partners; and local mapping contributors.

*3.6.1. 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 actors 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.

*3.6.2. VGI organisers.* The generation of spatial data by a VGI community is ordinarily encouraged by citizens 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 citizens 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 8).



**Figure 8.** VGI organisational structure for spatial data collection in OSM procedure.

**3.6.3. Local government.** 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.

**3.6.4. Local organisation partners.** 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 (Karang Taruna)—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 citizens 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.

*3.6.5. Local mapping contributors.* 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' [22]. 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. The researcher argues that if a community is homogeneous – for example, an indigenous community in a particular area – then it is more likely to rapidly accept participatory mapping in a VGI context. However, if a community in a particular place is heterogeneous – for example, indigenous and immigrants in the same territory - it needs intensive communication over a relatively long time period to achieve 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: Interviewed 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 activities with the purpose of achieving community goals. The discussion in the next section explores community empowerment theory.

### *3.7. The role of community empowerment through VGI activities to support spatial planning formulation*

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, 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 categorized in four degrees or intensities: 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. [23]

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 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.

#### 4. Conclusion

This paper has aim to investigate ‘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.

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