

Exploring the Possibility of Developing Multipurpose Marine Cadastre in Indonesia

Andri HERNANDI, Rizqi ABDULHARIS, and S. HENDRIATININGSIH, Asep Yusuf SAPTARI, Indonesia

Key words: multipurpose marine cadastre, geographic information system, Indonesia

SUMMARY

Marine information is required to support of sustainable development and it should be well managed to support good marine governance. How to get good marine information? a multipurpose marine cadastre could be applied. This paper attempt to examine how to multipurpose marine cadastre may be developed in Indonesia. The need to provide marine cadastre information in a common geographic information system framework would be highlighted. An integrated marine information system can benefit comprehensively as well as a visual approach to data analysis that able to finding the best location for marine resources. And also, multipurpose marine cadastre able to choose quickly see the applicable jurisdictional boundaries, restricted areas, laws, critical habitat locations, and other important features. The resulting of this study elaborates some aspect that possible to developing mutlipurpose marine cadastre in Indonesia.

Exploring the Possibility of Developing Multipurpose Marine Cadastre in Indonesia

Andri HERNANDI, Rizqi ABDULHARIS, S. HENDRIATININGSIH and Asep Yusuf SAPTARI, Indonesia

1. INTRODUCTION

As a maritime nation and the largest archipelago in the world with a number of islands around 17,500 islands, Indonesia has a range of coastal areas is about 81,000 km long coastline and vast marine area is 5.8 million square km or $\frac{3}{4}$ of the total area of Indonesia. From the 5.8 million square km sea coverage, 0.3 million square km is Indonesia's marine territory, 2.8 million square km is categorized as archipelago waters and Exclusive Economic Zone as large as 2.7 million square km. Therefore, the economic potential for marine and fisheries sector is a prime mover which can be used to overcome the economic crisis towards an advanced and prosperous of Indonesia. Unfortunately, the huge marine resources potential of Indonesia has not been optimally managed. This is due to the fact that the marine sector only donated 12% of 1998's Indonesia Gross Domestic Income. Along with the effort of Government of Indonesia to intensify the management of marine resource, conflicts of interests have been arising.

This is understandable because the sea could be seen as a basic human need, especially coastal communities in conducting various activities for the benefit of places e.g. fisheries, trade and so on . Increased human activity and marine development in Indonesia is often a conflict of interest over the control of marine tenure, it would require a good marine management in its application. Marine management could be carried out either if it is supported by availability of good marine information.

Detailed marine information required in support of sustainable development and are important things to public administration as well as development planning. Given the importance of the marine information, the data needs to be managed marine cadastre in a system that is capable of supporting marine information services for various purposes. During its development , the cadastral system recommended to be implemented in a country is not only limited to the fiscal cadastre or legal cadastral, but also is directed to a wider variant into a multipurpose cadastre which is able to serve the information needs of marine for the benefit of various institutions or individuals.

Marine information is required to support of sustainable development and it should be well managed to support good marine governance. How to get good marine information? A multipurpose marine cadastre could be applied. This paper attempt to examine how to multipurpose marine cadastre may be developed in Indonesia. The need to provide marine cadastre information in a common geographic information system framework would be highlighted. An integrated marine information system can benefit comprehensively as well as

a visual approach to data analysis that able to finding the best location for marine resources. And also, multipurpose marine cadastre able to choose quickly see the applicable jurisdictional boundaries, restricted areas, laws, critical habitat locations, and other important features. The resulting of this study elaborates some aspect that possible to developing mutlipurpose marine cadastre in Indonesia. On the other hand, this paper explain to some aspects of multipurpose marine cadastre such as its legal, technical, and institutional aspect. Considering facts from the above, the authors argue that some aspects of multipurpose marine cadastre is of essential step on foundation of solid basis for development of multipurpose marine cadastre concept in Indonesia.

2. NEED FOR MULTIPURPOSE CADASTRE

Multipurpose marine cadastre provides a data management system that is easy to define, analysis, and easily accessible to a wide range of interests. With the overlap of various interests in a region, can facilitate the analysis required for the development of the region. For example, for the purposes of making a building condition data requires offshore waters, seabed sediment, navigation channel, cable track/subsea pipelines, and so on. With the centralized management of marine data will facilitate the process of data acquisition. This analysis resulted in a better quality and avoiding mistakes so that the implementation of activities in accordance with the technical standards and applicable laws.

Resource management will be facilitated by obtaining the data sourced from the relevant institutions that can be trusted. Indonesia is rich in marine resources because most of the area waters. Underutilized wealth for the benefit of society. With publications and data management resources that both are expected to boost the economy, especially the people who depend on seafood.

With multipurpose marine cadastre concept of centralized data management services simplify the data by government bureaucracy so that the work and the data resulting from the work of government departments or institutions can be well used by many people especially those who have an interest in the marine field. Government agencies and private organizations that have an interest in the marine field can backup data that has been measured or generated. Therefore, besides the data is useful for many people, the data can be stored so that it can be reused for different purposes.

Multipurpose marine cadastre is a tool to assist stakeholders in making important policy in the field of marine. Marine cadastre included in the decision support system that has the ability to optimize the computer system to help learn to identify problems, take the policy, help understanding the social environment after the implementation of the decision . Multipurpose marine cadastre with the decision-making system is also able to evaluate the various options so that decisions can be made in two ways of optimization and simulation. Decision-making optimization by setting the target value and then find the closest solution, while the simulation with trying to apply some solution options. The decision to give the best results if the data required in accordance with standard oceanographic data completeness information includes all objects both spatial and non- spatial information .

The data used in the construction of a multipurpose marine cadastre is stored in a database entity associated with a spatial aspect. Non-spatial data is an explanation of the phenomenon and element attributes contained in the sea area. In addition to binding relationships of spatial data and non-spatial, multipurpose marine cadastre can serve as a means of integration of data overlap between the interests in the marine area. In the process of data integration and data usage used through ODBC (Open Data Base Connectivity). ODBC is a standard method of sharing data between databases with application programs that require a variety of data services that are implemented in the form of database tables (Fineza, 2009)

3. ASPECTS OF MULTIPURPOSE MARINE CADASTRE

It is previously mentioned that some aspects of multipurpose marine cadastre is of essential step on foundation of solid basis for development of multipurpose marine cadastre concept in Indonesia. So that, it could be identified from some of these aspects must be clearly identified to determine the characteristics of marine information to support the development of a multipurpose marine cadastre.

3.1 Legal Aspects

In Indonesia, the regulations regarding multipurpose marine cadastre there are no specifics. However, this could be approached with the regulations pertaining to some law on the setting in the sea. Especially regarding the rights, restrictions and responsibilities on an object region marine cadastre, the legal aspects could be approached by some regulation are:

1. National jurisdictions in the form of internal waters, archipelagic waters, territorial sea, contiguous zone, Exclusive Economic Zone, and the continental shelf. According to the United Nations Convention on Law of the Sea (UNCLOS) in 1982 has provided a legal mechanism whereby a nation can extend its claims as far seaward as the limits of the continental shelf. As it explicitly deals with the rights, restrictions and responsibilities to the physical offshore, UNCLOS has created a complex multidimensional mosaic of potential private and public interests. When coastal zone management programs, and internal jurisdiction and administration issues are added on, a clear understanding of the nature and extent of offshore interests is crucial for decision-making purposes (Ng'ang'a, Nichols, Shuterland, & Cockburn, 2001). Indonesia has ratified UNCLOS by law No. 17, 1985. Consequently, Indonesia is only subject to the UNCLOS.

On the other hand, in 1996, Indonesia made Law No. 6 of 1996 on Indonesian Waters based on various considerations such as:

- With a growing range of interests and activities in the waters of Indonesia, the national and international interests in Indonesian waters needs to be organized, secured and developed in a focused and prudent in accordance with national development objectives.
- In addition to defense and security interests, unity-unity, and economic, as well as protection of the environment against the dangers of pollution and preservation as

well as interests in the management and utilization of the waters of Indonesia, felt increasingly urgent.

- In this legislation emphasizes the need for management of the marine environment in the national interest. For the management of the marine area covers a lot of interest, so we need the concept of a multipurpose marine cadastre to support environmental management with national development goals.

Later in the year 2007 has been enacted a law on the Management of Coastal Areas and Small Islands. These laws regulate the management of coastal areas and small islands. In the context of multipurpose marine cadastre, there are different management constraints that could be done by the provincial or district. It became a benchmark in the making maps of the area and the provision of management rights over the sea.

2. Local jurisdictions in the form of provincial marine areas and marine area for county or city. based on Law no. 32 of 2004 on Regional Government explained that these area was given the authority to manage marine resources in the region include:
 - a. Exploration, exploitation and management of marine resources;
 - b. Administrative arrangements;
 - c. The spatial arrangement;
 - d. Enforcement of regulations issued by the county or the delegated authority by the government;
 - e. Participate in the maintenance of security;
 - f. Participate in the defense of state sovereignty.

Provincial government authority to manage marine resources most distant twelve (12) nautical miles measured from the shoreline seaward toward the waters off the province and one third (1/3) of the provincial government jurisdiction granted to the district / city.

On the other hand, according to Government Regulation no. 25 of 2000 relating to the authority of the Central Government has the duty to:

- a. Establishing policies and setting exploration, conversion, management, and utilization of natural resources in the waters of the sea area outside the waters of 12 nautical miles, including the waters of the archipelago and the sea bottom and the EEZ and continental shelf;
- b. Determination of policy and regulation management and utilization of precious objects from the ship sank in waters beyond 12 nautical miles;
- c. Establishment of policies and arrangements that include maritime boundary in the marine boundary autonomous regions and boundaries of international maritime law;
- d. Standard-setting coastal management and small islands;
- e. law enforcement in the sea area outside the waters of 12 nautical miles and in the waters of 12 nautical miles and the specific terms relating to relating to international interests;

While the provincial government has a duty to:

- a. Structuring and management of marine areas in the province;
- b. Exploration, exploitation, conservation and management of marine resources in the sea area only provincial authority;

- c. The water permit the cultivation and fishing in marine waters in the sea area of provincial authority;
 - d. Supervision of fish resources in the sea area of provincial jurisdiction.
3. Regions based on ownership and utilization rights are classified into 10 types, namely:
- a. Resources of oil, gas, and mineral refers to the Law No. 11 of 1967 concerning the basic provisions of the Mining and Law No. 2001 on Oil and Gas;
 - b. Fishery refers to the Law No. 31 of 2004 on Fisheries;
 - c. Biodiversity refers to the Law No. 5 of 1994 on Biodiversity;
 - d. Shipping refers to the Law no. 1 of 2008 on the Ratification of ILO Convention no. 185 Concerning Revising the Seafarers Identity Documents Convention 1985;
 - e. Conservation refers to the Law No. 5 of 1990 on the Conservation of Natural Resources and Ecosystems;
 - f. Treasure under the sea, the setting was the submission of the Draft Invitation into Law;
 - g. Indigenous culture, the setting was the submission of the Draft Invitation into Law;
 - h. Cables and submarine pipeline refers to Law No. 6 of 1996 on Indonesia Waters;
 - i. coastal areas refers to the Law No. 27 of 2007 on the Management of Coastal Areas and Small Islands;
 - j. Marine tourism refers to the Law No. 9 of 1990 on Tourism.

3.2 Technical Aspects

Data acquisition in the field of marine and coastal areas, especially in the marine aims to present information and data relating to the marine and coastal areas. Of providing the data and this information compiled a maps to fulfill various needs related to the field of marine and coastal areas and textual data in the form of a book / atlas and attribute data in GIS. The maps prepared for the needs of marine navigation and other technical purposes while the maps of coastal areas and marine structured to the needs of coastal and marine management including planning for coastal and marine spatial planning. Base map products generated by the agency/ institution regarding marine maps and coastal areas.

Type of map used in the marine purposes multipurpose cadastre is specially designed marine maps for navigation and shipping safety. In a sea map are shown the basic points, shoreline, baselines, the boundaries of the territorial waters, coastal morphology and configuration, including the depths of the sea, and limit the ownership rights for the purpose cadastre.

In the 1982 UNCLOS, presentation boundary lines on a map marine waters carried by the appropriate scale, with a note that the selection of the scale should include related areas and can ensure the best accuracy, such as:

- a) The scale of 1:1000 or greater, for residential areas and important areas such as pipes and cables under the sea.

- b) The scale of 1:2500, for conservation areas, pond area, as well as marine aquaculture
- c) Scale of 1: 10000, to the waters and territory mining resources of oil, gas, and mineral

Projection map needs to be selected in accordance with the essential purposes of a multipurpose marine cadastre by minimizing distortion in certain areas due to the projection. For the purposes of a multipurpose marine cadastre in Indonesia using a transversal mercator (TM) projection system.

Meanwhile, the datum used as a reference tool positioning of a point on the surface of the earth for the benefit of the MMC is divided into:

- a) Horizontal Datum can use the latest datum SRGI 2012 as the official datum used in mapping in Indonesia, which has been established by the Geospatial Information Agency (*Badan Informasi Geospasial/BIG*). Horizontal datum Indonesia currently registered for sea map DGN - 95 is adopted from the WGS - 84 by GALOS (Geodetic Aspects of the Law of the Sea) is the WGS - 84 geodetic datum which is using satellite positioning methods.
- b) Vertical Datum as a reference positioning vertical height and depth. Vertical Datum generally refers to areas of low water (chart datum) can be defined from measurements of tidal and divided into several types of MLLW (Mean Lower Low Water) , LLWLT (Lower Low Water Large Tide) , LLWST (Lowest Low Water Spring Tide) , and LAT (Lowest Astronomical Tide) . The big difference in the type of chart datum because of low water are constantly changing due to the combination of the position of the earth, moon, and sun. Vertical datum using Lowest Astronomical Tide either (LAT) has been recommended by the IHO. But according to the UNCLOS in 1982, if not have LAT datum can use the Mean Sea Level (MSL) or Chart Datum (CD) with a 30-day observation.

The method used for the measurement of mechanical depth data (dradloading) use wave (Echo Sounder), which can be applied in horizontal positioning marine parcels used in multipurpose marine cadastre is generally divided into: a) Mechanical: use stretch line. b) Optical: using optical theodolite c) Electronic: using Electronic Total Station, GPS, and more.

Some base map that may be used in MMC are outlined in Table 3.1.

Table 3.1 Some base map that may be used in MMC

No.	Base Map	Description	Source
1	Map of Indonesia Coastal Environment	These maps are used for planning the management of marine resources and coastal development in Indonesia. This map was produced by the scale of 1:50,000 and 1:250,000 scale and serves as a terrestrial and marine resources, especially coastal regions are presented on a single sheet map with the scale and the same projection system.	GEOSPATIAL INFORMATION AGENCY

No.	Base Map	Description	Source
2	Marine & Navigation Maps	Marine maps (navigation map) are presented in the Mercator projection, Spheroida Bessel 1841, WGS (World Geodetic System) 72, WGS 84, with a scale of 1: 7500 to 1: 1,000,000. The information presented in the form of signs (objects) on the ground, danger signs, buoy, beacon lights and depths characteristics according to international standards. This map is intended for security for vessels to navigate.	Hydro-Oceanographic Office – Indonesian Navy
3	Gebco Maps (General Bathymetric Chart of The Ocean)	GEBCO map is presented in a Mercator projection, spheroida Bessel 1841, Scale 1: 1,000,000 to the usual classification. The data presented in the form of sea depth data	Hydro-Oceanographic Office – Indonesian Navy
4	Exclusive Economic Zone Maps and Outline Map Lists	EEZ map with scale 1: 1,000,000 and baseline maps with a scale of 1: 200,000 served in mercator projection, spheroida Bessel 1841 (EEZ Map) and spheroida WGS 84 (Outline Map Lists), with the usual classification. Contains data contributing to a sea map, the position of the base point, the territorial sea, and exclusive economic zone limit. Usefulness of guidelines for law enforcement at sea and to navigate	Hydro-Oceanographic Office – Indonesian Navy
5	Technical Maps	Technical maps presented in mercator projection, spheroida Bessel 1841, WGS 84, scale 1: 2,000 to 1: 25,000 with the usual classification. Data are presented depending on the technical function of the map in question. Technical map can be a map for engineering purposes (engineering), specialized port map, map of submarine cables and the like.	Hydro-Oceanographic Office – Indonesian Navy
6	Marine Tourism Maps	Peta wisata bahari disajikan dalam proyeksi Mercator, spheroida Bessel 1841, berskala 1 : 10.000 sampai dengan 1 : 25.000 dengan klasifikasi biasa. Data yang disajikan selain data-data untuk kepentingan bernavigasi, juga informasi kepariwisataan seperti suhu, curah hujan, arah dan kecepatan angin, arah dan kecepatan arus, tempat menyelam dan lain-lain. Berguna untuk bernavigasi bagi kapal-kapal kecil dan pariwisata bahari.	Hydro-Oceanographic Office – Indonesian Navy
7	Map of Indonesian archipelagic sea lanes (Alur Laut Kepulauan Indonesia/ALKI)	ALKI maps can be made from the results of the survey and mapping of hydro-oceanography. These maps contain information about the Indonesian archipelagic sea lanes that are useful for navigation of foreign ships.	Hydro-Oceanographic Office – Indonesian Navy
8	Cadastre Map	Cadastral maps are presented in a Mercator projection tranverse 3 degrees, scale 1:1,000, 1: 2,500 and 1: 10,000. Data presented includes information about both the ownership information on land and in coastal areas. For example, for a Right to Space.	Land National Agency (BPN)

The final product is a multipurpose marine cadastre 3D map that covers the sea surface, water column, seabed, and the air space above the territorial waters. Multipurpose marine cadastre map combines the registration, juridical, depth maps, and other thematic maps which are

considered necessary as part of the administration, storage, and centralized control of the rights granted in marine geospatial.

Constraints faced is when the 3D data processing, information systems development, differences in data format, and availability of field data. In the process of data integration and data usage used through ODBC (Open Data Base Connectivity). ODBC is a standard method of sharing data between databases with application programs that require a variety of data services that are implemented in the form of database tables.

3.3 Institution Aspects

According to identified regulations on utilization of marine space, there are three groups of stakeholder, which are public, private and community institution. Ministry of Marine and Fisheries has a wide-spread authority on utilization of marine space. Besides Ministry of Marine and Fisheries, there are other public institutions involved in utilization of marine space, such as BAPPENAS, BIG, LAPAN, JANHIDROS TNI AL on marine spatial planning; BKPM, Ministry of Agriculture, Ministry of Transportation, Indonesian Navy and Ministry of Treasury on Fisheries; higher learning institution and BPPT on coastal and small islands management; Ministry of Home Affairs, Ministry of Industry and Trade, Ministry of Energy and Mineral Resource, Ministry of Forestry and State Ministry of Environment on exploitation of abiotic natural resources; State Ministry of Environment, BAPEDAL and Ministry of Forestry on marine and fishery resources conservation; Army and Police on national defense and orderliness; and Ministry of Culture and Tourism, Ministry of Home Affairs and Ministry of Transportation on tourism. However, authority of Ministry of Marine and Fisheries is mostly overlapped with tasks of other public institutions, except on fisheries, while, on the other hand, the above mentioned public institutions besides Ministry of Marine and Fisheries have been performing their tasks before the foundation of Ministry of Marine and Fisheries on, not only utilization of marine space, but also on utilization of space in general.

Stakeholders from public institution group could further be divided into those which are responsible on policy constitution, policy implementation and research on utilization of marine space. In general, all above stakeholders are responsible on constitution of policy on this issue. However, only Ministry of Marine and Fisheries, Provincial and Municipal Government, Indonesian Army and Police, Ministry of Forestry, Ministry of Culture and Tourism, State Ministry of Environment, BAPEDAL, Ministry of Energy and Mineral Resources and BKPM are responsible on policy implementation. Furthermore, there are several stakeholders on utilization of marine space capable on performing researches, such as higher learning institution and BPPT.

In general, tenureship in Indonesia is given by BPN. BPN has a long history on delivering tenureship in Indonesia. BPN was initially established by Dutch Colonial Government on 1823 with Cadastral Agency (*Kadastrale Dienst*) as its name on its initial years. Between 1942 and 1955, its name was altered into Bureau of Land Registration. Since 1955, Bureau of Land Registration became an independent body and named as Ministry of Agrarian.

However, since its initial establishment, BPN tasks have only been related to land. Even though it is the only eligible public institution for delivering tenureship, BPN's role and readiness on delivering tenureship of marine space is still questioned.

Furthermore, considering the promulgation of Act of Republic of Indonesia no. 22 year 1999 and Act of Republic of Indonesia no. 32 year 2004 on Regional Governance, Provincial and Municipal Government have a full authority to grant permits on management and exploitation of natural resources. This includes granting permits on management and exploitation of marine and fishery resources. However, as land has been managed centrally in Indonesia, Provincial and Municipal Government could not issue tenureship. Issuance of tenureship is managed by representation of BPN in provincial and municipal level.

According to (Abdulharis, Djunarsjah, & Hernandi, 2008) have concluded that the authors argue that re-organization of Ministry of Marine and Fisheries is necessarily to be done. This is due to the overlapping of jurisdiction of this ministry with other public institutions, in particular on marine issues. Other stakeholders of management of marine resources have mostly performed their tasks on management of natural resources in general. Even though it is necessary to establish special organization focused on management of marine resources, considering its extensive scope, however, by relegating authority on marine to specific ministries and agencies that have been performing tasks related to management of marine resources, in particular on marine cadastre. In case that this kind of arrangement is implemented, the authors suggest that there should be separation on management land and marine resources in ministry and agency in question. On the other hand, the authors suggest that Ministry of Marine and Fisheries is focusing on fishery issues, while, at the same time, acting as coordinator on marine cadastre issues.

Specifically on issuance of tenureship on marine cadastre, the authors suggest BPN to hold full control on delivering tenureship and permits related to marine cadastre. Considering its wide-spread coverage, BPN is capable of performing this task. Considering full authority of Provincial and Municipal Government due to Regional Governance Act, Provincial and Municipal Government could consult further arrangement in relation to permit granting on management of marine and fishery resources to BPN. However, considering its limited authority on issuance of tenureship and permits, in which formally limited to land resources only, the authors suggest that BPN should be re-organized and brought-back to its initial structure as Cadastral Agency.

4. DISCUSSION AND CONCLUSION

Based on the discussion of aspects to consider in building a MMC, it could be concluded as follows:

- Indonesia is a maritime country having adequate marine spatial information;
- Some legal products already support for the development of MMC;
- Information about marine almost available in some institutions as a basis for the development of information MMC;

- Some agencies are already qualified in the development of the MMC

According to the conclusion above, the suggestion to apply a MMC required a separate legal basis in the form of legislation in which establishes may be required as follows:

- A technical provisions in both the measurement and mapping methods, scope activities, procedures, administrative provisions, and others.
- The imitation of authority and interests of all parties associated with the cadastral marine.
- The description of the process of acquiring the rights to the parcels.
- Explanation of the legal requirements for marine spatial definition.

ACKNOWLEDGMENT

We wish to thank the Bandung Institute of Technology for funding this research. We also to thank Faculty of Earth Science and Technology of Bandung Institute of Technology for providing the exit permit for attending FIG Congress 2014, Kuala Lumpur, Malaysia, 16 – 21 June 2014. The authors would like to express their gratitude to Ms. Fineza Ilova, Mr. Deny Zaenudin and Mr. Catur Purwanto for their priceless contribution on composition of this paper.

REFERENCES

- Abdulharis, R., Djunarsjah, E., & Hernandi, A. (2008). Stakeholder Analysis on Implementation of Marine Cadastre in Indonesia. Integrating Generations, *FIG Working Week 2008*, Stockholm, Sweden 14-19 June 2008
- Fulmer, J. (2008). Working Towards a Multipurpose Marine Cadastre. *Publication: Cartography and Geographic Information Society*. Retrieved from Cartography and Geographic Information Society: www.cartogis.com
- Law of Republic of Indonesia no. 22 year 1999 on Regional Governance
- Law of Republic of Indonesia no. 26 year 2007 on Spatial Planning
- Law of Republic of Indonesia no. 27 year 2007 on Management of Coastal Areas and Small Islands
- Law of Republic of Indonesia no. 32 year 2004 on Amendment of Act of Republic of Indonesia no. 22 year 1999 on Regional Governance
- Ng'ang'a, S., Nichols, S., Shuterland, M., & Cockburn, S. (2001). Toward a Multidimensional Marine Cadastre In Support Of Good Ocean Governance. *International Conference on Spatial Information for Sustainable Development*. Nairobi, Kenya: FIG.
- UNCLOS
- Williamson, I., Enemark, S., Wallace, J., & Rajabifard, A. (2009). *Land Administration for Sustainable Development*. Australia: ESRI.

BIOGRAPHICAL NOTES

1. Andri Hernandi
 - Academic Background: B.Sc and Ph.D on Geodesy and Geomatics Engineering from Institute of Technology of Bandung and Master of Urban dan Regional Planning from Institute of Technology of Bandung;
 - Current Position: Lecturer at Surveying and Cadastre Research Division, Faculty of Earth Sciences and Technology, Institute of Technology of Bandung;
 - Research Interest: Land Administration, Photogrammetry and Cultural Preservation
2. Rizqi Abdulharis
 - Academic Background: B.Sc on Geodesy and Geomatics Engineering from Institute of Technology of Bandung and M.Sc on Geomatics from Delft University of Technology;
 - Current Position: Ph.D on Spatial Planning in Developing Countries at Technische Universität Dortmund;
 - Research Interest: Land administration in particular on customary land tenure, geographic information science, spatial data infrastructure and disaster management.
3. S. Hendriatiningsih
 - Academic Background: B.Sc, M.Sc and Ph.D on Geodesy and Geomatics Engineering from Institute of Technology of Bandung;
 - Current Position: Associate Professor at Institute of Technology of Bandung and Head of Surveying and Cadastre Research Division, Faculty of Earth Sciences and Technology, Institute of Technology of Bandung;
 - Organisational Experience:
 - Member of Indonesian Surveyor Association;
 - Member of Indonesian Geodetic Engineer Association;
 - Member of American Geophysical Union on 1995;
 - Research Interest: Surveying and 3D Cadastre
4. Asep Yusup Saptari
 - Academic Background: Graduates on Geodesy and Geomatics Engineering from Institute Technology of Bandung and Master Of Science in Photogrammetry And Geoinformatics of HFT Stuttgart;
 - Current Position: Academic Assistant at Surveying and Cadastre Research Division, Faculty of Earth Sciences and Technology, Institute Technology of Bandung and Ph.D candidate on Remote Sensing at Institute Technology of Bandung;
 - Organisational Experience:
 - Member of Indonesian Surveyor Association;
 - Research Interest: Surveying, Cadastre and Geoinformatics

CONTACTS

Andri Hernandi
Surveying and Cadastre Research Division
Faculty of Earth Sciences and Technology
Institute of Technology of Bandung
Labtek IX-C, 1st floor
Jl. Ganesha 10
Bandung 40132
INDONESIA
Tel. +62 22 2530701 ext. 3479
Fax +62 22 2530702
Email: andri@gd.itb.ac.id; andri_hernandi@yahoo.com
Website: <http://surkad.gd.itb.ac.id>