

# **The Development of Marine Cadastre Conceptual Model for Malaysia**

**Ashraf ABDULLAH, Abdullah Hisam OMAR, CHAN Keat Lim, Zakaria MAT AROF,  
Hasan JAMIL and TENG Chee Hua, Malaysia**

**Key words:** marine spatial, marine cadastre, definition, model, conceptual

## **SUMMARY**

Malaysia is a country surrounded by ocean,. Malaysia has a wide range interest in the surrounding ocean which include among others trade, employment, transportation, food, recreation, fishing, marine engineering, aquaculture, tourism, oil and gas, marine protected area itself which acquires proper administration and management. The United Nations Convention on the Law of the Sea (UNCLOS) institute a comprehensive jurisdictional regime where Malaysia can claim, manage and utilize its maritime territories. The law and regulations for a marine area is indistinct till today despite the use of marine spatial planning for administrating and managing. This is due to the issue on boundary description in marine area that is vague, inaccurate, or incorrectly represented on a map. Therefore the law and regulations for a marine area are not effective. The objective of this paper is develop the marine cadastre definition and marine cadastre conceptual model from Malaysian perspective using Langkawi Island as a case study. The methodology used in this study includes direct interview, discussion and examination of marine national law associated to marine spatial matters. This study also conducted through colloquium activity with marine institution of Langkawi Island. Finally, this result is establish the marine cadastre definition and conceptual model where consist of main entities and attribute for support the it's implementation. As the conclusion, this marine cadastre model it is hoped will be can be used for marine spatial administration in Malaysia.

# **The Development of Marine Cadastre Conceptual Model for Malaysia**

**Ashraf ABDULLAH, Abdullah Hisam OMAR, CHAN Keat Lim, Zakaria MAT AROF,  
Hassan JAMIL and TENG Chee Hua, Malaysia**

## **1. INTRODUCTION**

Malaysia has a total land mass of approximately 330,000 square kilometers and 4320 kilometers of coastlines. The land masses support a population of 25 million (Fauzi, 2006). It also lies close to the equator between Latitudes 1<sup>0</sup> and 7<sup>0</sup> North and Longitudes 100<sup>0</sup> and 119<sup>0</sup> East. The United Nations Convention on the Law of the Sea (UNCLOS) institutes a comprehensive jurisdictional regime where Malaysia can claim, manage and utilize its maritime territories.

In line with provisions of UNCLOS, Malaysia implemented two jurisdictions in the marine administration that separated between the federal government and state government. According to the Emergency (Essential Powers) Ordinance, No 7 1969 states that State territorial waters shall be construed as a reference to the sea adjacent to coastal administration there is not exceeding 3 nautical miles measured from low water mark. With this, the state government controls up to 3 nautical miles from low water mark whilst the federal government has jurisdiction and management responsibility from the said 3 nautical miles limits to the outer edge of the Exclusive Economic Zone and Continental Shelf. Later, on 22 June 2012, The Emergency (Essential Powers) Ordinance, No. 7 1969 (P.U. (A) 307 A/1969 was withdrawn as soon as the Territorial Water Act 2012 was established.

## **2. MARINE CADASTRE IN MALAYSIA**

Malaysia is a federal state where its marine jurisdiction and management responsibility is separate between the states and the central (federal) government. It is a federal state where its marine jurisdiction and management responsibility is separate between the states and the central (federal) government. The amendments to the Emergency (Essential Powers) Ordinance, No 7 1969 states that territorial water shall be constructed as a reference to such part of the sea adjacent to control the coast thereof not exceeding 3 nautical miles measured from low water mark. With this, the state government control up to 3 nautical miles from low water mark whilst the federal government has jurisdiction and management responsibility from the said 3 nautical miles limits to the outer edge of the EEZ and continental shelf. Later on 22 June 2012, The Emergency (Essential Powers) Ordinance, No. 7 1969 (P.U. (A) 307 A/1969 was withdrawn as soon as the Territorial Water Act 2012 was established.

The introduction of marine cadastre in Malaysia is still at an early stage with compared to other countries like Australia, United States and Canada. These countries are also in the development stage and still searching the best approach to implement marine cadastre although the study was begun a decade ago. Langkawi Island is the best practices in marine cadastre case study and offers many characteristics and elements parallel to marine spatial issues and activities. In other words, the state authority practices in marine alienation concept but that situation is not fully implemented in the proper marine spatial planning. There is no guideline and marine policy made about the marine spatial planning and procedure in Malaysia. This situation is also similar to Malacca practices regarding the marine spatial alienation and planning. The scenario is all the practices implemented follow the National Land Code 1965 guideline. Unfortunately, the execution of this administration system is not relevant to be fully applied in marine area.

The concept of marine cadastre in Malaysia is not being delivered for the whole agency related to the marine sector. It is because the awareness about the marine cadastre is not coming into marine stakeholders and also has ambiguity about marine cadastre definition in Malaysia environment including the lacking of legislation to implement it. Most of the marine institutions or the government authorities in Malaysia do not fully understand marine cadastre. This is the difficulty to ensure the marine cadastre that must be established in a legal condition and expanded to governments and publics.

Therefore, in an effort to develop marine cadastre in Malaysia should study the legal and technical aspects are two very important components as well as supported by other components. In Malaysia, the practice of marine alienation occurs in a situation but nevertheless this is carried out based on the current rules and regulations and it does not put the marine territory as an element to be recognized as a valid piece of legislation. Table 1 show that the comparison between the land cadastre and marine cadastre in term of from legal and technical aspect for Malaysia perspective.

ISSUE	MARINE CADASTRE (A.Ashraf et. al.(2012))	LAND CADASTRE
Legal/Regulations	Territorial Water Act 2012 - Need to amend to National Land Code	National Land Code 1965 State Land Rule 1966
Stakeholders to alienation	Suggested to State and District/ Land Office	State/ Land and District Office
Technical stakeholders	Suggested to JUPEM	JUPEM
Authorities	3Nm – State Authority ➤ 3 Nm – Federal Authority	State Authority
Area Covering	From LAT towards to Marine Area	From HAT toward to Land Area
Presentation of applications	Using the GIS Platform	Using the existing method – paper and e-map
Data required	GPS, water dynamic model, sonar, current, hydro graphic, tidal data, remote sensing Image	GPS, topography, Remote sensing/satellite image
Technical Issue		
• Boundary	Delimitation and Delineation	Demarcated
• Datum - Horizontal	Suggested to used the GDM 2000	Using GDM 2000/Cassini and GDM 2009/ Cassini
• Datum - Vertical	Suggested to used the My Geoid within 3 nautical mile only	Using – MSL for Engineering and Mapping
• Physically demarcated	No	Yes
• Uncertainty	Yes	No
• Dimensions	3D (aquaculture leases requiring depth) and 4D (introduction of time) boundaries needed in the marine environment.	2D - there are instances where 3D is needed (e.g. strata title) but the solution has been to establish 2D on top of 2D.
• Overlapping boundaries	Common	Rarely
• Implementations	Not systematic	Systematic

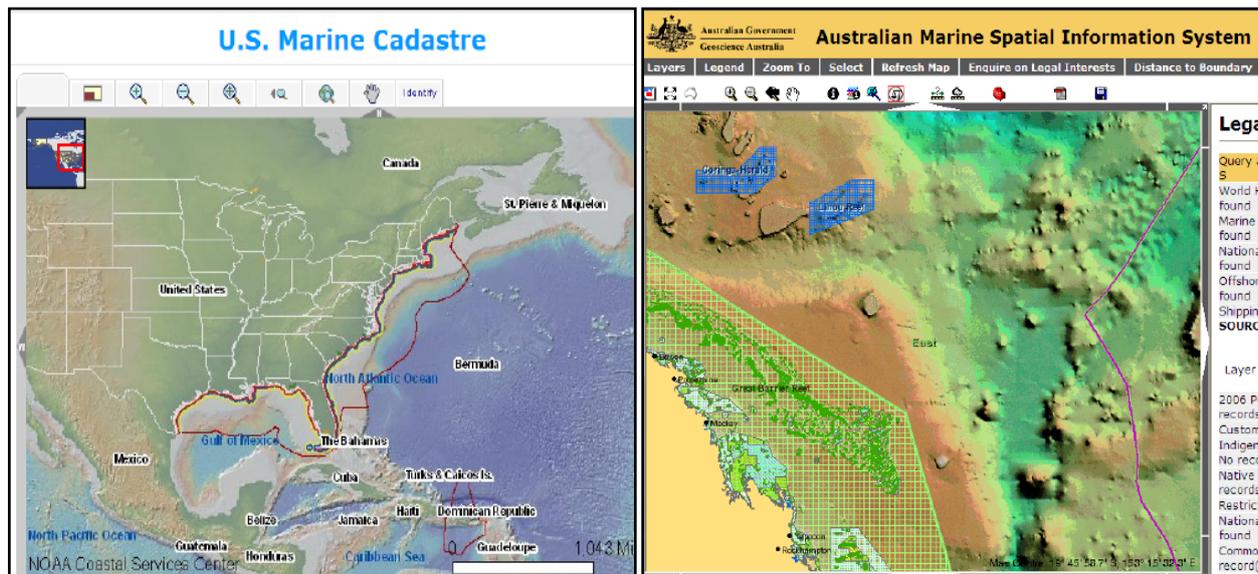
**Table 1:** The comparison between land and marine cadastre from Malaysia perspective

### 3. METHODOLOGY OF DEVELOPMENT

#### i. Review the marine cadastre paper in the world and national legal aspects

In the development of a conceptual model of marine cadastre, marine cadastre research on the development of the current international situation is seen in particular. However, the Malaysian perspective should be oriented atmosphere and environment of marine regions generated in the form of implementation of the law for the foundation. Applications and efforts in Australia, Canada, New Zealand, United State, South Korea, Turkey and other places become the basic reference material however this is still not a reality-based and still level towards defining and finding approach appropriate in the realization of this marine

cadastre. In the context of developing a model that is comprehensive and answering questions of implementation, the international reference is a useful initiative, but this does not indicate developments specifically in the concept and technical implementation but only focused on the discussion of finding a more suitable approach. United States and Australia are currently trying to develop a marine cadastre reality based on provisions supported by their respective countries, but still did not meet the development and environment in Malaysia from its technical aspects .



**Figure 1:** The sample of marine cadastre from respective country (Sutherland,2009)

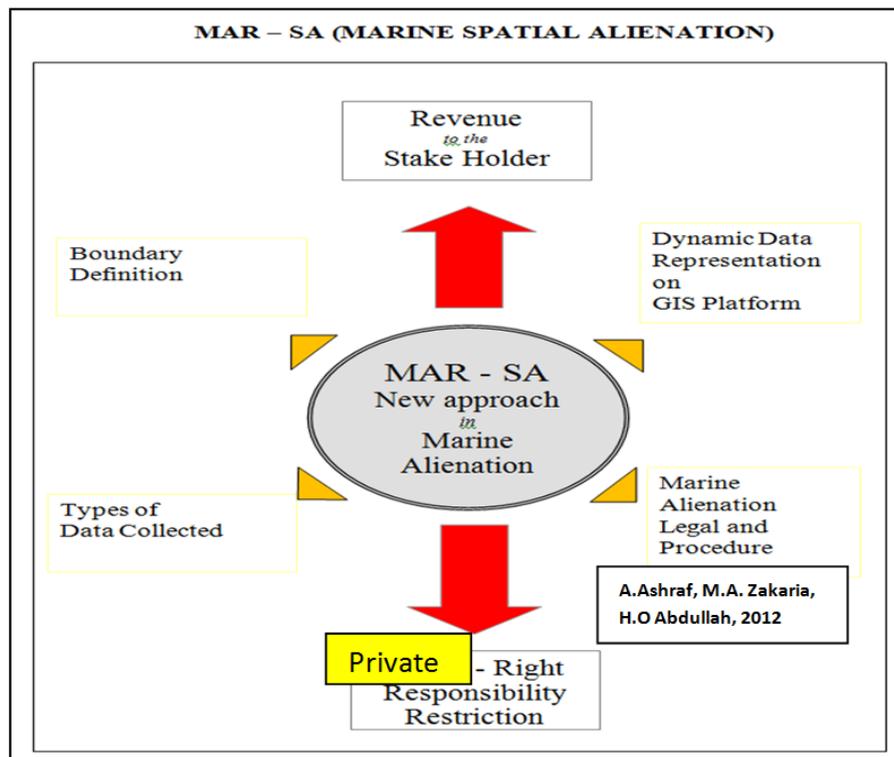
## ii. Interview and discussion

In addition to the international reference, this study also makes an interviews with government agencies involved in the administration and management of the marine region of Malaysia. A total of 23 agencies were found with various backgrounds with marine activities as their business. In this development , the essence of the interview was based on feedback directly related to marine cadastre general definition and also elements deemed logical and appropriate for the definition of the Malaysian marine cadastre. In this method, the range of issues and questions raised in line with the emerging challenges and make marine cadastre as a reality that can be adopted by all government agencies, private and personal. In this category, the activity of the interview conducted on three different of target group where is with government agencies, the private sector in marine activities as the core of their business and the public. Between government agencies is as the Department of Survey and Mapping Malaysia, the State Land Office, Marine Department of Malaysia, Kedah and Langkawi

Municipal Council. In addition, for the private party is the operator of hotels in Langkawi, the ferry operators and carriers, operators of tourism industry and fish culturist.

iii. The colloquium, discussion and final resolution.

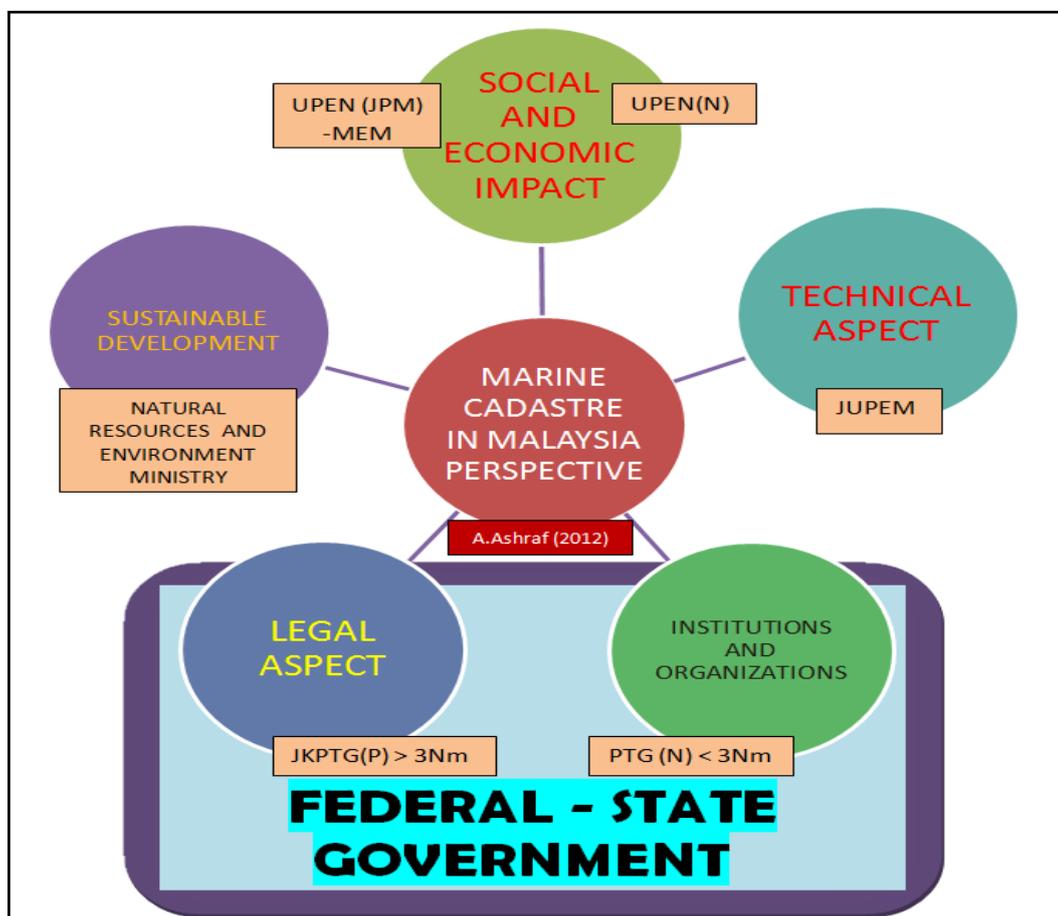
One of the other methods used in finding the definition and development of a conceptual model that includes all branches of the agency and marine needs is to hold a workshop or small colloquium held in conjunction with local government agencies and private parties involved in marine activities. In this activity, the presentation of information related marine cadastre, general concepts are presented along with the technical proposal can be implemented. This activity involving an two-way communication and discussion in a larger group of its members and the opinion of the marine cadastre development of a conceptual model as a whole gets criticism by all parties involved and a variety of backgrounds. Among the resolutions was such as under which a new term has been translated as follow: Marine Spatial Alienation. Figure 2 is show about the Marine Spatial Alienation concept from Malaysia perspective.



**Figure 2:** Marine Spatial Alienation Concept

iv. Testing through questionnaire for local authorities (Langkawi)

In getting a clearer formulation and certainty to the development of a conceptual model, a distribution of questionnaires was done specifically to local authorities in the area where the case study to see whether the model capabilities can be received by the government institution or not. These are the things that touch covers some key points in terms of marine cadastre described as Figure 3. The basis for this survey is to examine the level of understanding specifically related to marine cadastre and the ability to realize the conceptual model within 3 nautical miles off the coast of Malaysia. In the diagram state that marine cadastre conceptual structure of theoretical aspects in which 97% of respondents agreed with the structure of the marine cadastre as a fundamental beginning of this development of marine cadastre in Malaysia and clearly supported the implementation of a conceptual model that has been developed.



**Figure 3:** Component of marine cadastre and relating institution

#### 4. THE DEFINITIONS OF MARINE CADASTRE FOR MALAYSIA

This paper discusses marine cadastre definitions for Malaysia as the main topic. One of several definitions of the concept is as follows:

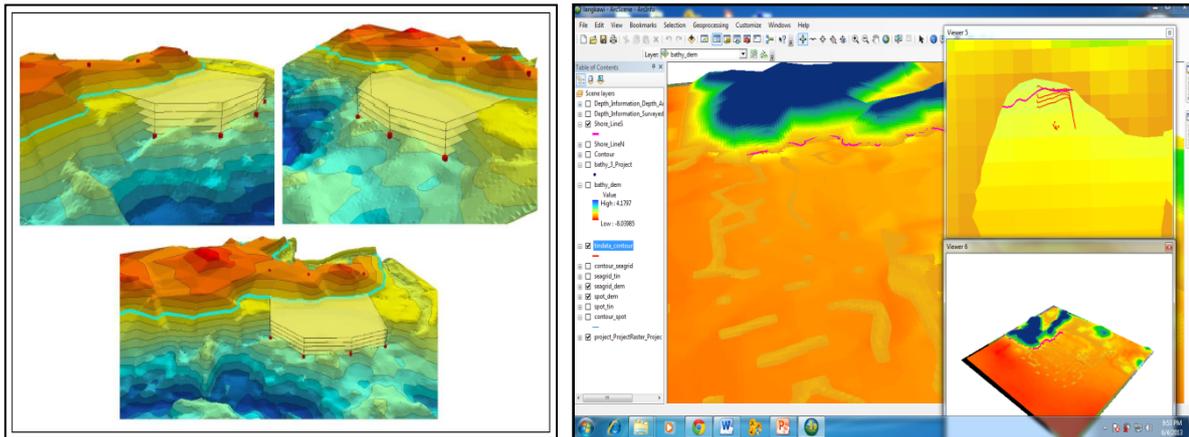
“A marine cadastre is a system to enable the boundaries of maritime rights and interests to be recorded, spatially managed and physically defined in relationship to them boundaries of other neighboring or underlying rights and interests. It is not about defining international boundary, but particularly about how a country administers marine resource in the context of UNCLOS”. – Ian P. Williamson and M. Sigit Widodo (Strain et al. 2006):

From this definitions, this paper will take up a definition of a marine cadastre in Malaysia as follows: A marine cadastre is a 3D marine parcel administration system with respect to the legal and systematic technical arrangement of marine spatial rights, restrictions and responsibilities for marine space activities.

Rational analysis on statement :

##### *A. A 3D marine parcel administration system*

The rational behind the 3D issue is because the priority of marine parcel definition which describe the marine nature and its condition. The component of vertical elements is important in variable to be considered. On the other side, the water column in marine area is the main component in marine structures and this is defined as a marine spatial and cannot be avoided from marine cadastre elements. This consideration will influencing method of practices, procedures and guideline and routines for three dimension parameter where the depth parameter will show the 3D in marine parcel will calculated as a volume. For example, the interpretation of marine parcels should be specified in legislation such as the meaning given by the study is marine parcel – a part of space in marine environment which may include air space, water column, seabed profile and subsea defined by legal boundary created for Malaysia (please refer Figure 4).



**Figure 4:** 3D Marine parcel

*B. With respect to the legal and systematic technical arrangement*

This context shows the requirement of marine cadastre implementations must be focused to particular legal and technical aspects (Figure 5). It was focus to record the marine spatial on rights, restrictions and responsibilities on social interactions, institutional aspects, values, taxes, and legal relationships associated with a marine parcel definition. It is conducted following the agenda to integrated the coastal zone and marine spatial management within the land policy and ocean policy framework.

	<p style="text-align: center;">TERRITORIAL SEA BILL 2012</p> <p style="text-align: center;">ARRANGEMENT OF CLAUSES</p> <p>Clause</p> <ol style="list-style-type: none"> <li>1. Short title, commencement and application</li> <li>2. Interpretation</li> <li>3. Limits of territorial sea</li> <li>4. Sovereignty in respect of the territorial sea</li> <li>5. Maps and charts of limits of territorial sea</li> <li>6. References to territorial waters in any other written law, etc.</li> <li>7. Power to make regulations</li> </ol>	<p style="text-align: center;"><b>UNDANG-UNDANG MALAYSIA</b></p> <p style="text-align: center;"><b>Akta 750</b></p> <p style="text-align: center;">AKTA LAUT WILAYAH 2012</p>
--	---	---

**Figure 5 :** Legal Instrument for land and marine administration.

### C. Technical arrangement of marine spatial rights, restrictions and responsibilities

i. This element involved technical aspects and the standard procedure will be used in this application. There are also to adapt land cadastre concepts into the marine environment situation and established the marine cadastre concept. This is built based on the three pillars or benchmarks as follows: i. about legal (3R-rights, restrictions, and responsibilities), ii. technicals aspect (surveying, mapping and spatial data infrastructure) and iii. the related institutional (formal and informal institutions). Figure 6 shows the marine spatial management example.

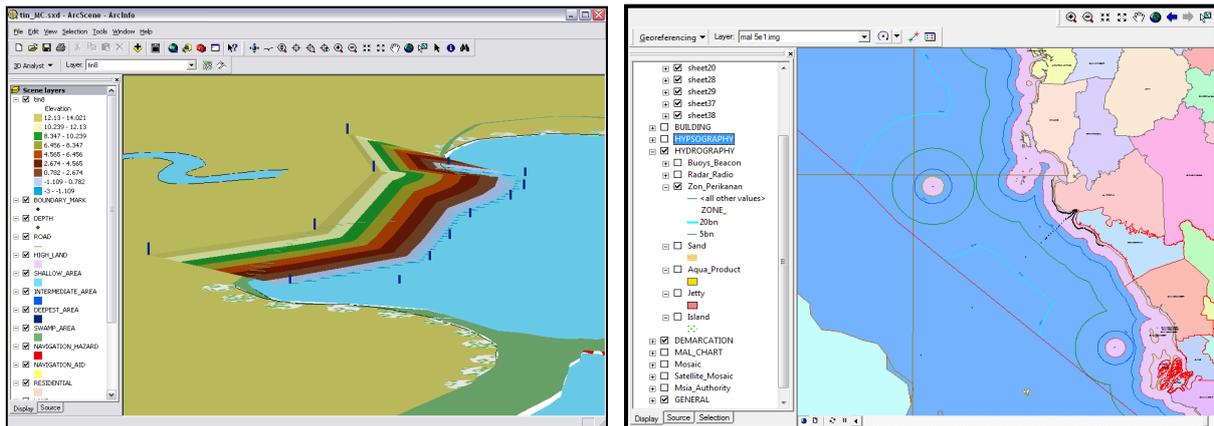


Figure 6: Marine spatial management

### D. The marine space activities

Marine space activities are the activities of community at the sea and coastal area to generate their living culture and strongly build the local economy through marine natural resources (see Figure 7). Moreover, marine cadastre lays in a completely different situation as that on the land. The most important problem is that there is no physical benchmark and boundary on the seabed. That is why the definition of marine cadastre in Malaysia must follow these requirements:

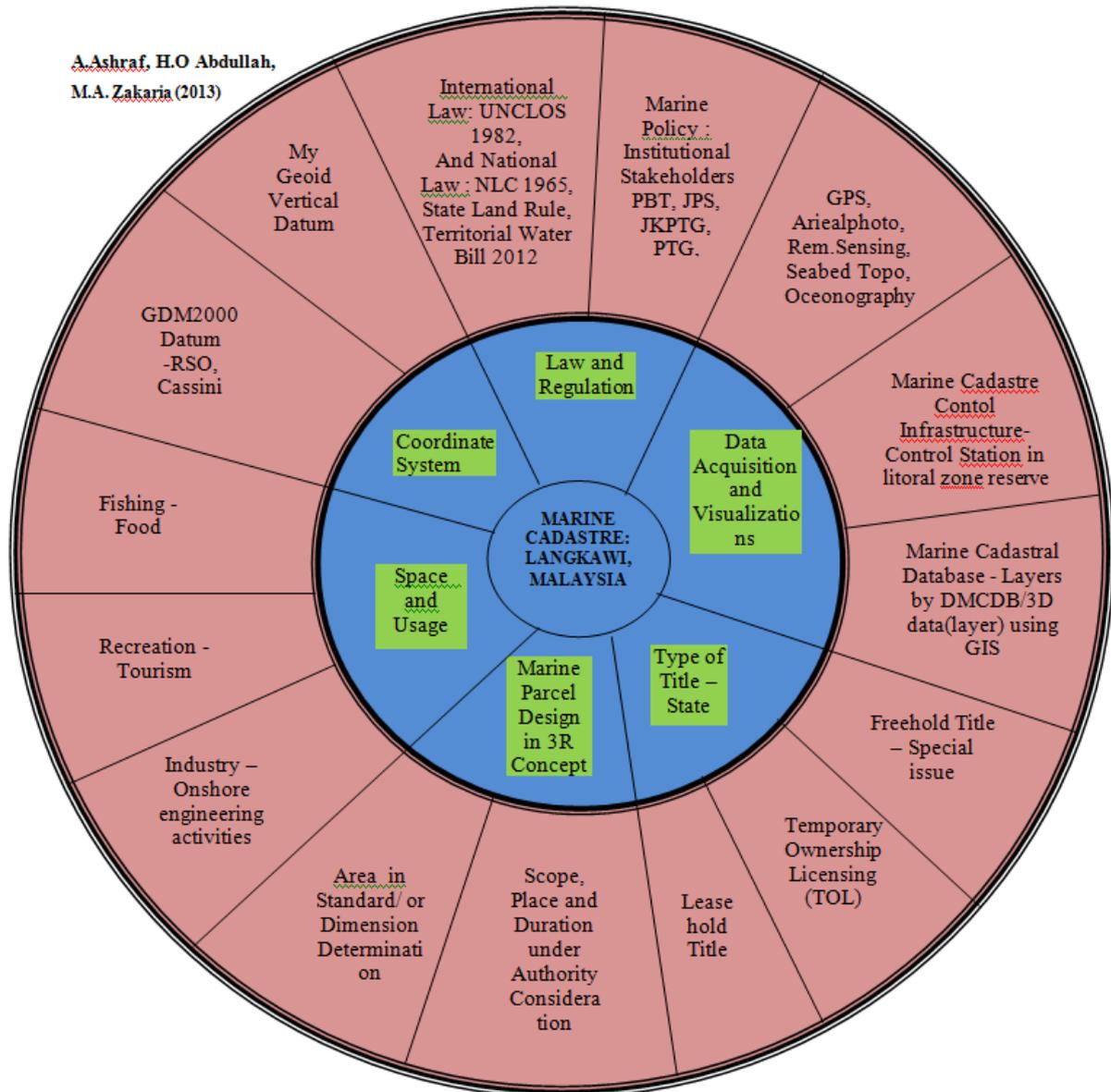
- The federal and state governments are fully responsible for the marine boundary determination and respect to legal procedures.
- The documentations on marine parcel in spatial context in terms of giving the marine ownership.
- The marine spatial arrangements on rights, restrictions and responsibilities must be cooperated into administration and authorities procedures.



**Figure 7 :**Marine activities

## **5. CONCEPTUAL MODEL OF MARINE CADASTRE FOR MALAYSIA**

The conceptual model needs to be developed in order to implement the marine cadastre exclusively. This model consist matters on how to commence the structure of marine cadastre system up to the execution phase. The result is a case study was carried out in Langkawi Island. This area is chosen for the case study because it is similar to Malaysia model of an island concept. This model focuses on the implementation of marine cadastre based on the six entities and several attributes to support that entities scope:



**Figure 8:** Marine Cadastre Conceptual Model

a) Coordinate system

The development of Malaysia Geocentric Datum 2000 (GDM2000) and RSO/Cassini Datum Projection is seen as suitable datum for marine cadastre application. Geocentric system by definition have their center at the center of mass of the earth and the direction of their axes are defined arbitrarily (usually using averaged astronomical phenomena).

## b) Law and regulation

The marine cadastre concept will be successful if supported by the appropriate law and regulation on marine management and practice for marine parcel. The law and regulation is dependent on two components: local and international. The local law must be examined under marine cadastre contexts such as National Land Code 1965, Continental Shelf 1966, Territorial Sea Act 2012, State Land Rule and Baselines of Maritime Zones Act 2006. Whereas the international law is related to United Nations Convention Law of The Sea 1982 and Convention on the Territorial Sea and the Contiguous Zone 1958.

## c) Data Acquisition

In achieving practical realization of the reference frames, there is a need for a practical approach to their implementation and application, and recognition that processes need several applications for data collections as the basic requirement. Digital Marine Cadastre Database using the GIS applications is suggested to fulfill several requirements. The DMCDB is a new orientation on marine spatial data management.

## d) Type of Title and Duration

Compared to the land cadastre, the elements of the boundary mark was easier depending on the marine situation. Lease hold was proposed for marine ownership suggested to 30 to 60 years only based on authority consideration and focus to activities such as fish cage, the aquaculture purposes, the marine animal feedings industry and recreational activities. For the alternative in marine ownership, the Temporary Ownership Licensing (TOL) can adapt from land cadastre concept into marine area and approved by State Government. However, the technical aspect and practices must taking into account that purposes of TOL also National Land Code 1965 as the main reference. In final title aspect, this is suggestion for special marine activities and generate for well-being of the community such as Tenaga Nasional Berhad (TNB) and Syarikat Air Kedah (Kedah water company) this is suggested to give the marine alienation for 99 or 999 years based on condition requirements. Anyhow, all the suggestion of marine alienation is under Register Office (State).

## e) Marine Parcel Design

The marine parcel design is required to design the marine parcel for marine alienation and consider about the complexity of the marine environment. Two aspects identified are volume/area under standard specified and another is volume/area based on authority consideration which is that design is to handle the complexity of the marine environment. Marine parcel arrangements in layers were adopted. Any applications of marine parcel in

marine alienation must be a priority to an earlier application to ensure that is not overlapped with the other stakeholder. Area in standard specified is proposed by the applicants together with concrete and relevant reason of the application while the volume/area based on authority consideration was proposed by the State Authority after considered these area is compact by many agencies and stakeholders. The parcel design is required to define the marine parcel for marine alienation, administrative and record. It is important to identify specified zone and area in the most systematic manner. This is also present the marine parcel layers arrangement to clarify the 3R and minimal conflicting with stakeholders.

#### f) Space and Usage

This part highlighted 3 aspects of examples marine space and usage especially to define term and condition

- i. Recreation – The tourism perspective includes marine park exploitation and mangrove exploration have a good impact of country's economy as it can generate high revenue and an indirectly become main contributor for country incomes. Government has to look seriously into the issues in order to exploit the marine sources.
- ii. Fishing – Malaysia aims to increase fisheries production by one third from Malaysia income sources. Malaysia's fisheries industry has reached the half way stage in the government's programme that is to increase the nation's annual fisheries production. Fisheries have been identified as a strategic sector in the government's programme to increase domestic food production.
- iii. Industry – Various onshore engineering activities, covering wide range of goods and services based on the maritime sector. It would thus cover the activities that are resource based including cabling, monumentation and marine biotechnology activities.

## 6. CONCLUSION

The marine cadastre is not only about maritime issue but as an alternative to optimize the marine sources in Malaysia. This paper produces the conceptual design for marine cadastre model to make a direction for practices in reality. It is important for Malaysia to look deeper into legal and technical aspects especially for marine cadastre to be done in Malaysia.

## 7. REFERENCES

Ahmad Fauzi Nordin (2006). *Country Report on Marine Administration*. JUPEM Pg. 23-27.

A. Ashraf, H.O. Abdullah, M.A. Zakaria (2012) *Definition of Marine Cadastre from Malaysia Perspective*. Kolokium Kadaster Marine: Aplikasi Agensi Kerajaan Tempatan Pulau Langkawi, 20-23 Jun 2012

---

The Development of Marine Cadastre Conceptual Model for Malaysia, (6866)

14/16

Ashraf Abdullah, Abdullah Hisam Omar, Chan Keat Lim, Zakaria Mat Arof, Hasan Jamil and Teng Chee Hua (Malaysia)

FIG Congress 2014

Engaging the Challenges - Enhancing the Relevance

Kuala Lumpur, Malaysia 16 – 21 June 2014

Fowler, C., & Treml, E. (2001). *Building a marine cadastral information system for the United States -- a case study*. Computers, Environment and Urban Systems, 25(4-5), 493-507.

Liu, W.-H., Wu, C.-C., Jhan, H.-T., & Ho, C.-H. (2011). *The role of local Government in marine spatial planning and management in Taiwan*. Marine Policy, 35(2), 105-115.

National Oceanography Directorate, *Malaysia Ocean Policy 2011-2020*. (2011) Ministry of Science, Technology and Innovation, Malaysia

Ng'ang'a, S., Sutherland, M., Cockburn, S., & Nichols, S. (2004). *Toward A 3D Marine Cadastre In Support Of Good Ocean Governance: A Review Of The Technical Framework Requirement S*. Computers, Environment and Urban Systems, 28(5), 443-470.

Strain, L., Rajabifard, A., & Williamson, I. (2006). *Marine administration and spatial data infrastructure*. Marine Policy, 30(4), 431-441.

Sutherland M., (2009) Developing A Prototype Marine Cadastre. 7th FIG Regional Conference, Hanoi, Vietnam Oct. 19-22. 2009

Rizqi Abdulharis, Eka Djunarsjah And Andri Hernandi, (2008) *Stakeholder Analysis On Implementation Of Marine Cadastre In Indonesia*. FIG Working Week 2008 Stockholm, Sweden 14-19 June 2008

## BIOGRAPHICAL NOTES

**Ashraf Abdullah** is a PhD student in Built Environment, Universiti Teknologi MARA with research interest in marine cadastre from legal and technical aspect.. He received guidance from supervisors from UiTM and UTM in future marine cadastre project in Malaysia. He holds a Bachelor's and Master's degree from the Universiti Teknologi Malaysia, Johor. For the position, he is also a lecturer at Universiti Teknologi MARA, Perlis and teaching marine technology and marine engineering

**Abdullah Hisam Omar** is a senior lecturer at the Faculty of Geoinformation and Real Estate, Universiti Teknologi Malaysia (UTM) since 2000. He obtained a Bachelor Degree, Master of Science and a Doctor of Philosophy from Universiti Teknologi Malaysia, Malaysia. His research work is in the areas of Land and Marine Cadastre. His current research is on marine legal framework for Malaysia funded by Ministry of Science, Technology and Innovation (MOSTI). Abdullah Hisam is a member of the Institution of Surveyors, Malaysia (ISM).

**Chan Keat Lim** graduated from the University of Nottingham with a Master of Science in Geographical Information Systems (Distinction) and Universiti Teknologi Malaysia with a Bachelor of Science in Land Surveying. Currently, he is the Director of Survey (Cadastral Legislation) in the Cadastral Division, Department of Survey and Mapping Malaysia

(JUPEM).

**Zakaria Mat Arofis** a Associate Prof in Department of surveying science and geomatic. He received the Master of Degree in GIS from University of Nottingham and Doctor of Philosophy in GIS from Universiti Sains Malaysia, Pulau Pinang. Currently, he is Head of Department in Surveying Science Department at Universiti Teknologi MARA Perlis.

**Teng Chee Huais** a Director of Survey Division (Cadastre) at Department on Survey and Mapping Malaysia (DSMM).He holds a Doctorate from the University of Newcastle Upon Tyne, United Kingdom, a Masters Degree (Survey Engineering) from University of New Brunswick in Canada, a Postgraduate Diploma in Photogrammetry (Distinction) from ITC, Netherlands and a Bachelors Degree in Survey (Land) from University Teknologi Malaysia.

**Hasan Jamilis** a Deputy Director General of Survey and Mapping II at Department on Survey and Mapping Malaysia (DSMM).He holds a Master Degree in GIS from Edinburgh University, United Kingdom and a Bachelors Degree in Survey (Land) from University Teknologi Malaysia.

## CONTACTS

### **Ashraf Abdullah and Zakaria Mat Arof**

Department of Surveying Science and Geomatic, Faculty of Architecture, Planning and Surveying,

Universiti Teknologi Mara (Perlis),

02600 Arau, Perlis, MALAYSIA.

Email: ashraf@perlis.uitm.edu.my, asuitm@gmail.com

### **Abdullah Hisam Omar**

Department of Geoinformation, Faculty of Geoinformation & Real Estate,

Universiti Teknologi Malaysia (UTM),

81310 UTM Johor Bahru, Johor, MALAYSIA.

Email: cikbelle@gmail.com, abdullahhisam@utm.my, aizzatazhar@yahoo.com

### **Chan Keat Lim, Hasan Jamil, Teng Chee Hua,**

Department of Survey and Mapping Malaysia (DSMM),

Wisma JUPEM, Jalan Semarak,

50578, Kuala Lumpur, MALAYSIA.

Email: klchan@jupem.gov.my, hasan@jupem.gov.my, tengcheehua@jupem.gov.my,