



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

Work Group 4.4: Maritime and Marine
Spatial Information Management

MARINE ACTIVITIES AND DELINEATION ZONES: IN THE CONTEXT OF MALAYSIA MARINE GEOSPATIAL DATA INFRASTRUCTURE (MGDI) DECISION (6890)

by

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June 2014



XXV FIG Congress

"Engaging the Challenges, Enhancing the Relevance"
16 - 21 JUNE 2014, MALAYSIA



XXV International Federation of Surveyors
Congress, Kuala Lumpur, Malaysia, 16 - 21
June 2014

Marine Activities and Applications Areas

- Many Natural and Anthropogenic Resources
- Like , Land Use / Land Cover (LULC concepts)
- Marine activities ocean use based (MAOU) – Table 1

Table 1: Categorization of Ocean uses (Hamid-Mosaku and Mahmud, 2014)

S/N	Traditional Marine-Based	Non-Traditional and New Marine-Based
i.	Marine Fishing	Marine Eco-tourism
ii.	Non-renewable resources - Crude Petroleum and Natural Gas Production	Marine Education
iii.	Sea Transport Services	Sports and Recreation,
iv.	Naval Administration, Sovereignty and Defence	Manufacture of Seafood
v.	Telecommunication	Marine engineering works and services; Manufacture of Marine Engines.
vi.	Cable Laying	Fresh water resource management
vii.	Industrial Discharge of Waste	Integrated coastal zone management
viii.	Aquaculture	Renewable resources: e.g. fish stock management.
ix.	Conservation	Habitat management
x.	Marine heritage	Ocean Research and Development
xi.	Marine Biotechnology	Disaster management and emergency response

Characteristics of marine environment & maritime activities

- **Constitutes Complex Systems**
- **Multi-Conceptual dynamics – multi-criteria, multi-participant, multi-agencies**
- **Fragmented and uncoordinated effects (custodianship)**
- **Dearth of research applications, - knowledge gaps in area of MGDI decisions**
 - **A.I. Techniques in SDI, MGDI**
 - **Intelligent systems**
 - **Decisions are often subjected to: uncertainties**
 - **Challenges of Aquatic Environment**
 - **Voluminous geospatial data**
 - **Unstable platforms (due to Sea / Oceans dynamics)**
 - **Cost implications**
 - **GIS, i-GIS, and Standards – e.g. IHO: S-100**
 - **Ease of acquisition,**
 - **Depths**
 - **New Technologies**
- **New paradigms – Alternative Solutions**
 - **Comprehensive evaluation index system (CEIS)**
 - based on MGDI initiative, for conservation, monitoring, and sustainability
 - intelligent Systems considerations, e.g. DNP

Vaez et al. (2007), provided a list of definitions of MGDI from different initiatives:

".....to enable simple, third party access to data and information that will **facilitate more effective decision making**....."

.....**management tool spatially describes** visualises and realises formally and informally **defined boundaries associated rights, restrictions and responsibilities** in the marine environment data layer

In respect of **regional SDI**, "the needs for identifying key factors that **facilitate development** through better understanding the **complexity of the interaction between social, economic and political issues**" (Rajabifard, 2002).

the process that translates knowledge into economic growth and social well-being (ARC, 2010)

● **MGDI to Support Decisions == MGDI Decisions**
MGDI Decision, 'a new concept in cognisance with MGDI initiative and development based on the understanding that there exists a multi-conceptual nature of stakeholders, characterised with different worldviews, and in the realms of decision making in relation to marine environment needs, hydrographical services, marine surveys services, and various applications that are being explored'

Marine Spatial Data Infrastructure (MSDI) is the component of NSDI that encompasses marine geographic and business information in its widest sense.

Objectives

- To identify and rank marine activities;
- To assess the factors for MGDI development and MGDI decisions;
- To determine the most viable MDZ(s) for these marine activities

Materials, Data and Methodology

Table 2 : Ranking of Marine Activities
 (Hamid-Mosleh)

S/N	Traditional Marine-Based	Ranking			Non-Traditional and New Marine-Based	Final selection
		Ranked value	Final selection	Final selection		
T1.	Non-renewable resources	10.33	a	NT1.	Integrated coastal zone management	a
T2.	Naval Administration, Sovereignty and Defence	9.33	b	NT2.	Disaster management and emergency response	b
T3.	Telecommunication	7.67	c	NT3.	Marine engineering works and services.	c
T4.	Marine Fishing	7.00	d	NT4.	Fresh water resource management	d
T5.	Sea Transport Services	6.00	e	NT5.	Renewable resources	e
T6.	Cable Laying	6.00	e	NT6.	Ocean Research and Development	f
T7.	Marine Biotechnology	5.67	f	NT7.	Manufacture of Seafood	g
T8.	Aquaculture	4.00	g	NT8.	Marine Education	g
T9.	Industrial Discharge of Waste	4.00	g	NT9.	Sports and Recreation	h
T10	Conservation	3.67	h	NT10	Marine Eco-tourism	h
T11	Marine Heritage	2.33	i	NT11	Habitat management	h

To assess the factors for MGDI development and MGDI decisions

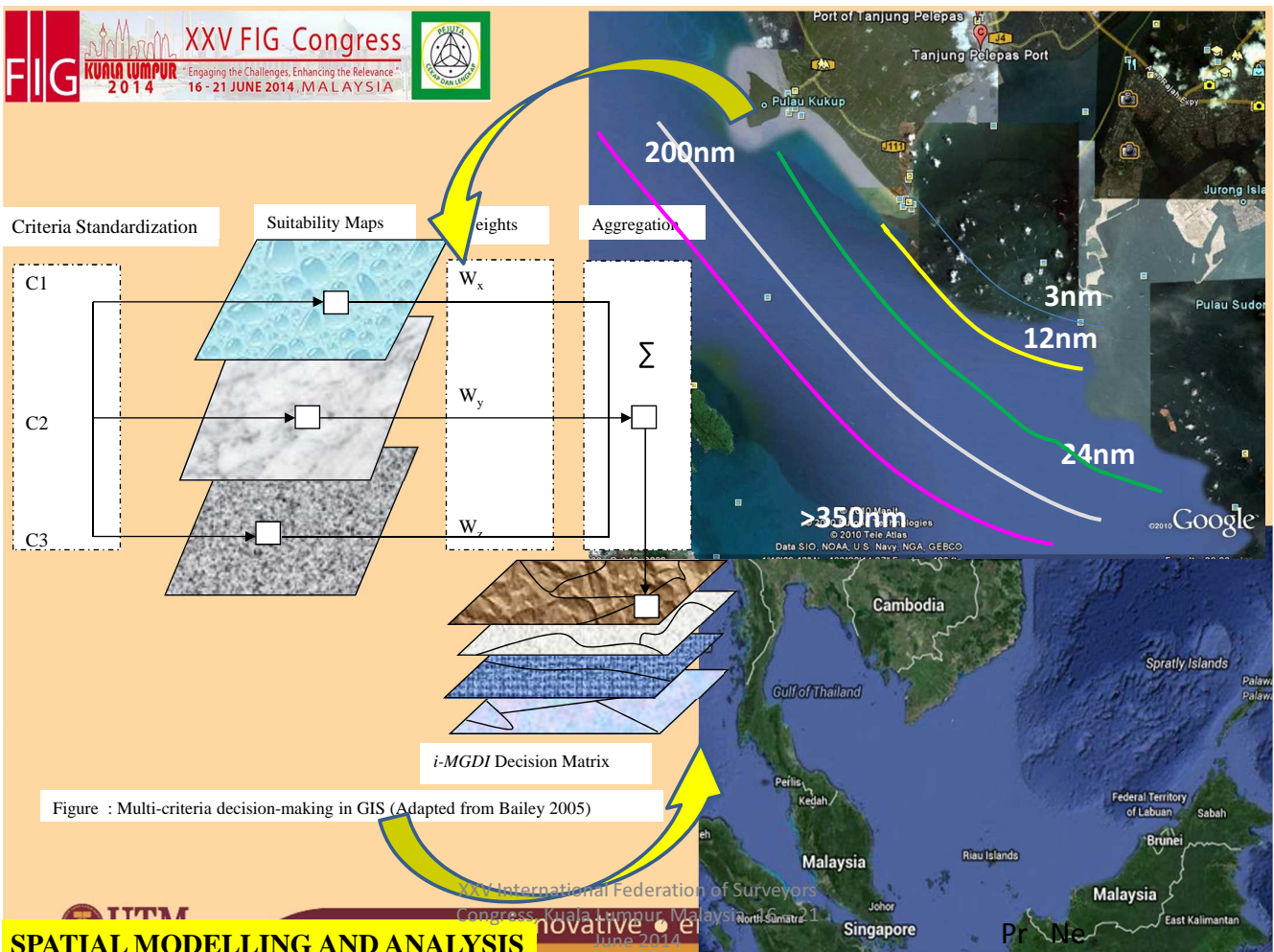
Comprehensive Evaluation Index System (CEIS)

- Quest for factors for the design and development of MGDI initiatives;
- Consists of:
 - seven (7) main criteria,
 - twenty eight (28) sub-criteria and
 - one hundred forty five (145) performance indicators

To determine the most viable MDZ(s) for these marine activities

Marine Delineation Zones (MDZs) as Alternatives using DNP method

- Based on CEIS considerations
- Survey instrument involves MCE model: the dynamic network process (DNP);
 - Distance elements used to depict the dynamics, unlike previous studies that use time;
- GIS-based multi-criteria decision analysis;
 - Geospatial modelling and analysis
- Integrates and transforms geographic data and value judgments
- To obtain overall assessment of the decision alternatives



Thus, indicating the marine activities are predominantly active in **Territorial Sea area (12nm)** from the shore; closely followed by **Internal Water**

Alternatives	Normal	Ranking
ALT.1_ Internal Waters	0.2615	2
ALT.2_ Territorial Sea (12nm)	0.2617	1
ALT.3_ Contiguous Zones (24nm)	0.0783	5
ALT.4_ Exclusive Economic Zones (200nm)	0.2268	3
ALT.5_ Continental Shelf and High Seas (>=350nm)	0.1717	4

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Conclusion

- DNP model extended using distance element to denote the dynamics unlike previous studies that time elements were used.
- This new model was implemented to determine the viabilities of Malaysian waters and maritime delineation zones for marine activities.
- The most highly ranked traditional marine activities were:
 - non-renewable resources; and naval administration, sovereignty and defence;
 - while the least ranked is marine heritage;
- On the other hand, the most highly ranked non-traditional and new marine-based activities are:
 - integrated coastal zone management; while the least are from both marine eco-tourism and habitat management.
- 180 variables were elucidated for MGDI and MGDI decisions
- Malaysia Territorial Waters is the most highly ranked MDZ / alternative; with predominating marine activities
- Geographic data and experts' value judgments were integrated and transformed
- Work Group 4.4: Maritime and Marine Spatial Information Managements





● The reviewers' comments appreciated

● Thank you all for your attention

● IDF award from UTM through MOE, Malaysia

● SURCON

● Univ. of Lagos, Nigeria

● Shukran

&

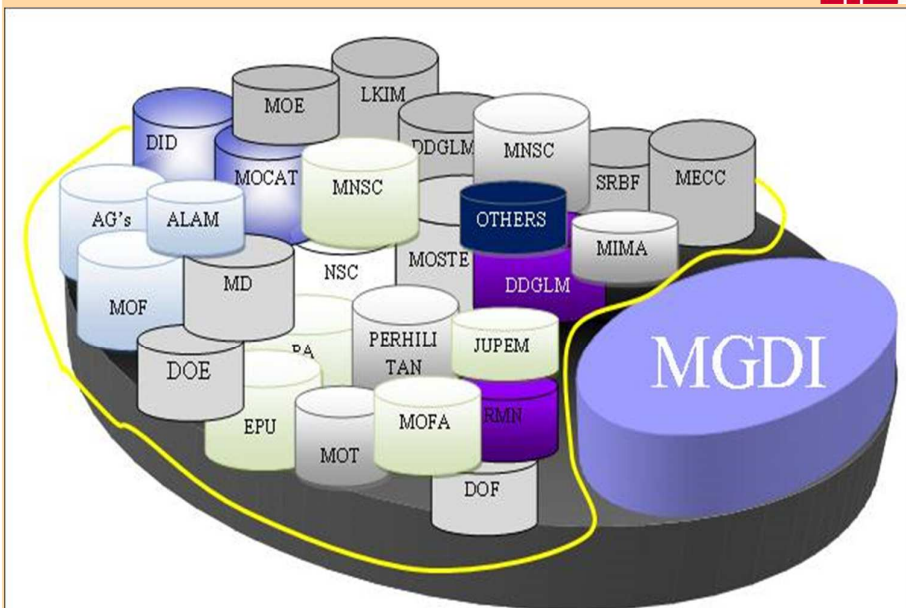
● Terima Kasih

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Multi-agencies Characteristics



*MOT Ministry of Transport; EPU Economic Planning Unit; PA Port Authority; MOF Ministry of Finance; MOFA Ministry of Foreign Affairs; SRBF Sarawak River Board; NSC National Shipping Council; MNSC Malaysia National Shippers Council; AG's Attorney General; DOF Department of Fisheries; MECC Maritime Enforcement and Coordinating Centre; LKIM Lembaga Kemajuan Ikan Malaysia; DDGLM Department of Director General of Land and Mines; MOCAT Ministry of Culture, Arts and Tourism; DID Department of Irrigation and Drainage; MOSTE Ministry of Science, Technology and Environment; DOE Department of Environment; MD Marine Department; RMN Royal Malaysian Navy; PERHILITAN Wildlife Protection and National Park Department; MOE Ministry of Education; ALAM Akademi Laut Malaysia; MIMA Maritime Institute of Malaysia.
(Source: Saharuddin, 2001; Miles, 1996).

Figure 4.0: The clusters of Maritime related agencies in relation to the MGDI.



The i-MGDI Comprehensive Evaluation Index System (CEIS) Paradigm

The CEIS for i-GDSS MDGI model is written in the general form (Equations 3.72 to Equation 3.84) as follows (adapted from, (Guariso and Werthner, 1989)):

$$M_{i-GDSSMDGI} = (E, S, N, D, R, T, P, \alpha, \beta, \delta) \quad 3.72$$

where

$$E = \{e_1 \dots \dots e_5\}, \text{ represents Economic criteria} \quad 3.73$$

$$S = \{s_1 \dots \dots s_3\}, \text{ represents Social criteria} \quad 3.74$$

$$N = \{n_1 \dots \dots n_5\}, \text{ represents Environmental criteria} \quad 3.77$$

$$D = \{d_1 \dots \dots d_4\}, \text{ represents Data \& Information criteria} \quad 3.78$$

$$R = \{r_1 \dots \dots r_4\}, \text{ represents Resources \& Management criteria} \quad 3.79$$

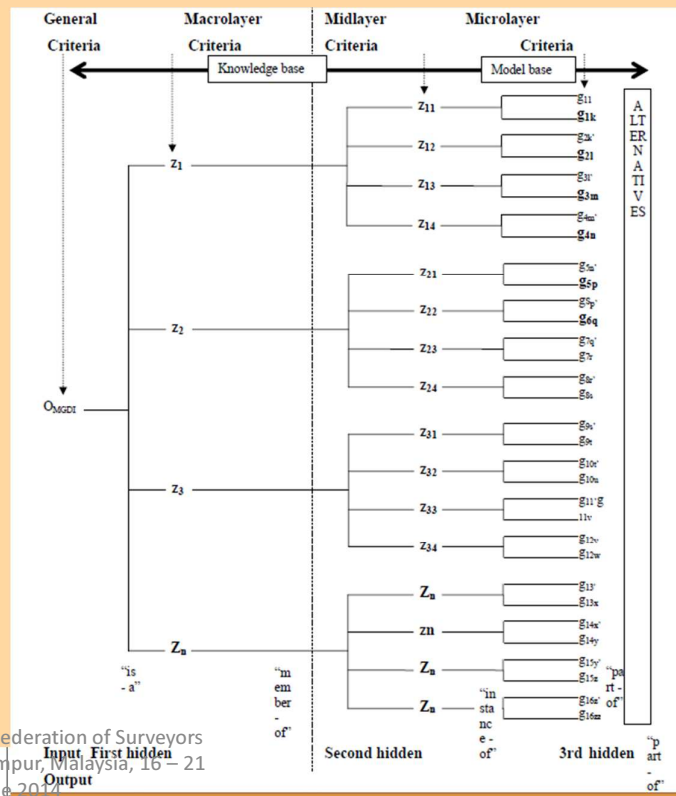
$$T = \{t_1 \dots \dots t_5\}, \text{ represents Technology criteria} \quad 3.80$$

$$P = \{p_1 \dots \dots p_2\}, \text{ represents People criteria} \quad 3.81$$

$$\alpha = \{\alpha_1 \dots \dots \alpha_5\}, \text{ denotes the state transition function mapping the output from } f_d \text{ to } f_{d+\Delta d} \text{ function for the} \quad 3.82$$

$$\beta = \{\beta_1 \dots \dots \beta_5\}, \text{ denotes the output function values of all the hidden layers.} \quad 3.83$$

$$\delta = \{\delta_1 \dots \dots \delta_5\}, \text{ represents the alternatives based on maritime zone distance.} \quad 3.84$$



TOTAL	7	28	145
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