

## PRE-AND POST-TSUNAMI COASTAL PLANNING AND MANAGEMENT IN INDONESIA

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## I. BACKGROUND

- Indonesia is both blessed with rich natural resources and natural disasters.
- Indonesia is the largest Archipelago on earth with more than 17,500 islands, 81,000 km coastline, and 75% (5.8 million square meters) of its total area is marine waters.
- From Sustainable Development perspective, Coastal Zone Management (CZM) in Indonesia is at the cross road.
- On the one hand, environmental pressures including overfishing, pollution, destruction of coastal ecosystems (e.g. mangroves, estuaries, beaches, coral reefs, and seagrass beds), loss of biodiversity, and natural hazards (e.g. earthquake, tsunami, and storm) have threatened the sustainable capacity of several coastal areas such as Aceh, Nias Islands, a part of Malacca Straits, the North Coast of Java, and the South Coast of Sulawesi. This means we have to reduce development intensity and rehabilitate such threatened coastal areas.

- On the other hand, as a developing nation with high unemployment rate (40 million people) and poverty (60 million people), we need to increase the utilization of coastal and marine resources. This is due to the fact that terrestrial resources are becoming scarce, while 70% of Indonesia's coastal and marine areas still possess large development potentials (renewable resources, non-renewable resources, and environmental services).
- So, the challenge for Indonesian CZM is how to proportionally achieve sustained high economic growth (average 7% per annum), distribution of welfare, maintenance of carrying capacity of coastal ecosystems, and mitigation of natural hazards in any given coastal area.

## II. THE NATURE OF TSUNAMIS AND THEIR IMPACTS IN INDONESIA

- Indonesia is one of the most prone countries on earth with respect to various natural disasters including earthquakes, volcano eruptions, tsunamis, storms, and hurricanes
- Indonesia is located in the World's Ring of Fire, where 75% of the world's volcanoes are present with 151 volcano mountains still active (the highest number on earth)
- From 1600 – 1999 there were 105 tsunami events in Indonesia:
  - The tsunami caused by the eruption of Krakatau in 1883. Its run-ups were reported higher than 30 m, and more than 36,000 lives were lost
  - The tsunami in Flores Island of East Nusa Tenggara Province in 1992. It was generated by earthquake had resulted in 1952 people died and 2126 people injured
  - The tsunami caused by earthquake in Banyuwangi, East Java Province (1994) had taken 38 death toll and 400 people injured
  - Tsunami in Biak, Irian Jaya Province (1996) had brought about 107 death toll

Table 1. Tsunami events in Indonesia during 1960-2000

No	Year	Epicentrum	Location	Maximum Run-Up (meter)	Casualties (people)
1.	1961	8,2 Lat. S; 122 Long.E.	Central Flores, East Nusa Tenggara	NA	2 died 6 injured
2.	1964	5,8 Lat. N; 95,6 Long.E	Sumatra	NA	110 died 479 injured
3.	1965	2,4 Lat.S; 126 Long.E	Seram, Sanana, Maluku	NA	71 died
4.	1967	3,7 Lat.S; 119,3 Long.E	Tinambung, South Sulawesi	NA	58 died 100 injured
5.	1968	0,7 Lat.N; 119,7 Long.E	Tambo, Central Sulawesi	8 - 10	392 died
6.	1969	3,1 Lat.S; 118,8 Long.E	Majene, South Sulawesi	10	64 died 97 injured
7.	1977	11,1 Lat.S; 118,5 Long.E	Sumbawa Island, West Nusa Tenggara	NA	316 died
8.	1977	8 Lat.S; 125,3 Long.E	Flores, Atauro Island, East Nusa Tenggara	NA	2 died 25 injured
9.	1979	8,4 Lat.S; 115,9 Long.E	Sumbawa, Bali, Lombok, West Nusa Tenggara	NA	27 died 200 injured
10.	1982	8,4 Lat.S; 123 Long.E	Larantuka, East Nusa Tenggara	NA	13 died 400 injured
11.	1987	8,4 Lat.S; 124,3 Long.E	Flores Timur, Pantar Island, East Nusa Tenggara	NA	83 died 108 injured

No	Year	Epicentrum	Location	Maximum Run-Up (meter)	Casualties (people)
12.	1989	8,1 Lat.S; 125,1 Long.E	Alor Island, East Nusa Tenggara	Data not available	7 died
13.	1992	8,5 Lat.S; 121,9 Long.E	Flores, Babi Island, East Nusa Tenggara	11,2 – 26,2	1952 died 2126 injured
14.	1994	10,7 Lat.S; 113,1 Long.E	Banyuwangi, East Java	19,1	38 died 400 injured
15.	1996	1,1 Lat.S; 118,8 Long.E	Palu, Central Sulawesi	NA	3 died 63 injured
16.	1996	0,5 Lat.S; 136 Log.E	Biak Island, Papua	13,7	107 died
17.	1998	2,02 Lat.S; 124,87 Long.E	Tabuna Maliabu Maluku	2,75	34 died
18.	2000	NA	Banggai	3	4
19.	2004	NA	Nangroe Aceh Darussalam, North Sumatera, Thailand, Srilangka, India, Malaysia, South Africa, etc.	34,5	>300.000 died
20.	2005	NA	Nias	3,5	NA
21.	2006	9,295 Lat. S -107,347 long.E	South Coast of West Java and Central Java Provinces	1-3,5	498 died 547 injured

Source: Subandono (2005) and BAPPENAS (2005)

▪ **The most catastrophic tsunami was caused by the Sumatra Earthquakes on 26 December 2004**

- **The Sumatra Earthquake generated giant tidal waves** (tsunami) which hit coastal areas in NAD and North Sumatra Provinces of Indonesia, Malaysia, Sri Lanka, Thailand, India, Maldives, and a part of South Coast of Africa. Its run-ups were reported higher than 30 m, and more than 300,000 lives were lost.
- **Indonesia was the hardest hit country** by the December 2004 Indian Ocean tsunami. About 132,000 people were died and 37,000 people missing (not found up until now) in NAD Province and the Islands of Nias.
- **Most coastal areas as long as 1000 km of coastline** (the same distance from Berlin to Paris) of NAD Province and almost all the Islands of Nias, North Sumatra Province with a total area of 12,345 square kilometers were devastated by the earthquake and the Indian Ocean tsunami.



Before Tsunami



After Tsunami



Environmental Destruction

### III. POST-TSUNAMI PROBLEMS AND ISSUES

▪ **Economic, Social, and Cultural Issues:**

- **Before tsunami the economy of NAD Province** was dominated by four sectors: agriculture (contributed 23% to RGDP), Fisheries (7%) oil and gas (20%), and processing industries (20%).
- **The tsunami had practically paralyzed the social-economic activities**
- **The number of unemployed people increased.** About 600,000 – 800,000 people (25% of the total NAD's workforce) loss their jobs (livelihoods)
- **The number of people displaced from their dwellings by the earthquake and tsunami is about 600,000 people.** Total number of house loss/damage 120,000 units and the average number of a family living in one house was 5 people.

Table 2. A Summary of Economic Facilities and Infrastructures of NAD Province, and Nias Regency of North Sumatra Province destroyed by the Indian Ocean Tsunami

Facilities & Infrastructure	Damage/Loss	Accomplishment of Rehabilitation and Reconstruction	
		October, 2005	April, 2006
1. Houses	120,000 unit	10,119 unit	41,734
2. Schools	2,006 unit	132 unit	524
3. Mosques & Churches	11,536 unit	141 building	489 building
4. Health Facilities	127	38	113 (7,380 health post)
5. Fishing Vessels	NA	4,379 unit	6,160 unit
6. Tambak	20,000 Ha	NA	9,258 Ha
7. Rice Fields & Plantation	87,901 Ha	30,926 Ha	37,926 Ha
8. Roads	3,000 Km	NA	490 Km
9. Bridges	120	NA	41
10. Micro & Small Enterprises	100,000	3,640	147,823
11. Fishing ports and fish landings	38 units	NA	NA
12. Ports/Harbors	14	5	5
13. Airports	11	2	5

Source: - BRR (2006); Bappenas (2005) - Notes: NA = Data are not available

**Table 3. Summary of Damage and Losses (in US\$ Billions)**

	Damage	Losses	Total
<b>Social Sectors</b>	1,684	57	1,741
Housing	1,398	39	1,437
Education	119	9	128
Health	82	9	92
Religious and culture	83	0	83
<b>Infrastructure</b>	636	241	877
Transport	391	145	536
Communications	19	3	22
Energy	68	0	68
Water and Sanitation	27	3	30
Flood control	132	89	221
<b>Productive Sectors</b>	352	830	1,182
Agriculture	84	141	225
Fisheries	102	409	511
Industry and Trade	167	280	447
<b>Cross-Sectoral</b>	252	400	652
Environment	155	394	549
Governance & Admin.	84	5	89
Bank and Finance	14	0	14
Emergency Expenditures	0	0	0
<b>TOTAL</b>	<b>2,924</b>	<b>1,528</b>	<b>4,452</b>

Source: Bappenas (2005)

### Agriculture Sector After Tsunami

- ✓ 20,101 ha of rice fields and 67,800 ha of plantations (coconut, cacao, coffee, cashew nuts, and sugar palm) were totally destroyed
- ✓ **Animals died or loss:** 208,000 ruminants (cows, buffalos, horses, etc.), 1,450,000 poultry (chickens, ducks, swan, etc.)

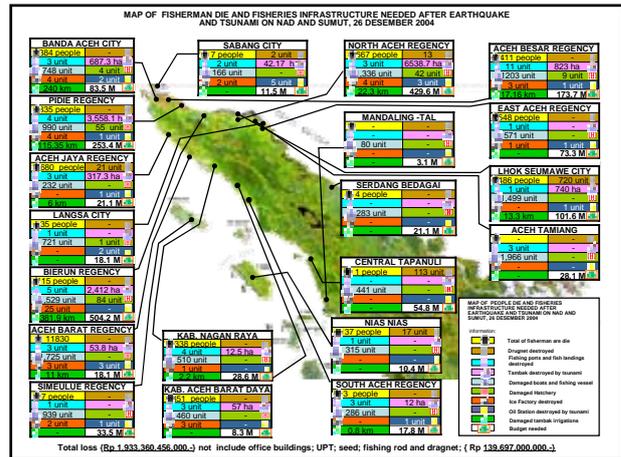
### Fisheries Sector

Before Tsunami

After Tsunami

- ✓ 130,000 people who used to work in the fisheries sector
- ✓ 36,597 hectares of tambak production (finfish and crustaceans such as shrimp, crab, milkfish, and sea bass)
- ✓ total number of fishing vessels 18,800 units; and 7,700 units (43%) of which were able to do fishing beyond 12 nautical miles (offshore)

- ✓ 104,000 of fisherman (capture fisheries) lose their job
- ✓ 20,000 ha of tambaks destroyed
- ✓ number of fishing vessels which were lost as many as 9,563 units consisting of 3,969 non-motorized fishing boats (41.5%), 2,369 small-motorized fishing vessels (24.8%), and large-motorized fishing vessels (33.7%)
- ✓ 38 fishing ports and fish landings were totally destroyed or heavily damaged by the tsunami



#### Economic, Social, and Cultural Issues:

- **During the emergency response phase (24 December 2004 – 26 March 2005)** there were issues about land captures by speculators, or powerful individual and business groups. After the BRR (Agency for Rehabilitation and Reconstruction) such issues were gradually resolved.
- **Violation of spatial planning enacted by the BRR**, particularly regarding setback zone, green belt, and buffer zone.
- **Many grants, aids, and projects (fishing vessels, tambak, infrastructures, etc.)** were not technically suitable nor culturally acceptable due to a lack of coordination between BRR and stakeholders (provincial and local governments, int'l donors, NGO's, and local communities).
- **Slow economic recovery programs** have resulted in **social distrust, frustration** and **'spoiled mentality'** of many tsunami survivors.

#### Environmental Issues:

- **Most coastal areas as long as 1000 km of coastline** (the same distance from Jakarta to Surabaya) of NAD Province and almost all the Islands of Nias, North Sumatra Province with a total area of 12,345 square kilometers were devastated by the earthquake and the Indian Ocean tsunami.
- **Land inundation by seawater and salination as well as suspected toxic substances brought by the tsunami.**
- **Destroyed/heavily damaged mangroves in NAD:** 84,000 ha or 24.3% of the total mangrove area 346,838 ha (Ministry of Forestry, 2005)
- **Destroyed/heavily damaged coral reefs in NAD:** 29,175 ha or 30% of the total Coral Reefs area 97.250 ha (Australian Institute Of Marine Science, 2006)
- **Destroyed/heavily damaged seagrass in NAD:** 600 ha Seagrass area (Australian Institute Of Marine Science, 2006)

## IV. POLICIES AND INSTITUTIONS

- Because of a multi-use nature, common property resource, and as the accumulator of externalities from land- and ocean- based human activities and natural processes; a lot of agencies at national, provincial, and local government levels involved in Coastal Zone Management (CZM) in Indonesia.
- At the national level, there are 22 agencies involved in CZM (Table 4). For instance:
  1. Ministry of Public Works, National Agency for Development planning, and Ministry of Marine Affairs and Fisheries (MMAF) are responsible for coastal and sea use planning.
  2. BPN (National Agency for Land Resources) is responsible for land administration and permit for land uses.
  3. MMAF responsible for coastal fisheries and aquaculture, sunken treasures, and small island resources (with Ministry of Home Affairs)

4. Ministry of Forestry responsible for mangrove (coastal forest) and Marine Protected Areas (with MMAF).
5. Ministry of Agriculture responsible for coastal agriculture.
6. Ministry of Energy and Mineral Resources is responsible for mining of energy and mineral resources.
7. Ministry of Tourism and Culture responsible for tourism.
8. Ministry of Transportation responsible for transportation.
9. Ministry of Home Affairs responsible for governance and civil servants.
10. Indonesian Maritime Council (DMI = Dewan Maritim Indonesia) is responsible for coordinating the management of coastal and ocean development at the national level.

Table 4. National Agencies and Their Functions in Coastal Zone Management in Indonesia

A	Coordination institution	Function
1	The State/Ministry of Environment	To coordinate national environmental policies & guidelines To arrange study and analysis process about environment impact
2	Department of Finance and Budgeting Diljen and National Development Planning Agency (NDPA)	To coordinate every activity of national development planning and to allocation resources for carry as program implementation
3	Department of Home Affairs	To coordinate every activity of regional development planning, include development fisheries on regional
4	Minister of Research and Technology (BPPT)	To coordinate research and development technology in inventory sea resources
5	Agency of Coordination Survey and National Mapping (BAKOSURTANAL)	To coordinate make maps (include coastal line)
6	Indonesian institute of sciences, center of oceanology research and development (P3O-LIPI)	Coordinate Research Ocean Activities, Center of Ocean Ecology Data information, and Giving advices to others Institution
7	Bappedda (Province, Regency or City)	Coordinate plan regional development and sectoral and enterprise sector in the Province, Regency or City, especially integrated coastal planning and spatial zone.

A	Coordination institution	Function
	<i>Ad-hoc committee</i>	
8	Indonesian maritime board	Coordinate and handling ocean and fisheries development problems
9	Committee coordinate national area and deep ocean	Handling the problem of border with neighbored country and international
10	Ocean security coordination agency	Coordinate and handling ocean protect problems, like to vessel piracy, illegal fishing, smuggling.
11	Province, regency/city workgroup	Coordinate implementation of fisheries project on region

Source: Dahuri, 2001

B	Sectoral institution	Function
1	Department fisheries and ocean	Development, arrange fisheries activity on coastal zone and ocean; development coastal zone and small island; development resources
2	Department of forestry	Development ocean and coastal zone ecosystem conservation activity
3	Department transportation	Responsible in ocean development as transportation media include protected ocean contamination
4	Department mining and energy	Development every activities that relation with oil and gas exploration on coastal zone (on-shore) and off shore
5	Department culture and education	Responsible on human resource development in ocean sector and ocean research
6	TNI AL/Agency Oceanography and hydrographic	Ocean territorial boundaries security, and gathering hydroceanography data and ocean area maps
7	Department industrialization and trade	Arrange every activity to development industry in ocean and coastal zone in clued protect industry waste
8	Department of settlement and regional means development reparation	Development every activity coastal engineer as infrastructure development coastal zone erosion protection.
9	Department of tourism	Development activity ocean and coastal zone tourism
10	Minister of micro economic entrepreneur and cooperation	Development cooperation business especially fisheries cooperation (KUD Mina) in coastal zone village
11	Ocean and Fisheries Agency	Planning and regional program on ocean and fisheries and help department of ocean and fisheries.

## THE GOVERNMENT SYSTEM IN INDONESIA BEFORE REFORM ERA STARTING IN 1999 (Act No.5/1974)

### Centralization

This principle is oriented toward sectoral development. Sectoral development include agriculture, forestry, mining, tourism, public works, transportation, etc. Each development has responsibility of technical departments. All policies, planning and supervision under each sectoral department's jurisdiction.

### Medebewind

Development remains the responsibility of the central government, but to enhance efficiency and effectiveness development is executed by local administration under supervision from the central government. Performance and funding are controlled by the central government.

### Decentralization

Devolution of government affairs from the upper level of government to lower levels of government. It is also defined as the delegation of authority from the central government to local administrations.

**THE GOVERNMENT SYSTEM IN INDONESIA  
AFTER REFORM ERA (Act No.22/1999 revised with Act No.32/2004)**

- **Autonomy**  
Gives local government and community (via local parliament) to identify and develop their own resources (human resources, natural resources, and man-made resources) for creating a developed, just, and prosperous local society by improving public services through Good and Entrepreneurial Governance in the framework of the Unity of Indonesian State.
- **Decentralization**  
Devolution of government affairs from the upper level of government to lower levels of government. It is also defined as the delegation of authority from the central government to local government.  
  
Except for **5 government affairs** (foreign affairs, currency and finance, justice, security and defense, and religion), others have been the responsibility of local (regency/district) government.

**SOVEREIGNTY AND JURISDICTION  
OVER INDONESIAN MARINE WATERS (Act No.32/2004)**

- **Sovereignty** over all Indonesian marine waters (inland, archipelagic, and territorial waters) is all belong to the National (Central) Government.
- **In line with UNCLOS 1982**, the jurisdiction of Indonesian Exclusive Economic Zone is also under the National Government.
- **Regency/District Government** has jurisdiction (rights and obligations) to explore, utilize, and manage (including to conserve) coastal and marine resources occurring within an area from the coastal base line at the lowest tide up to 4 nautical miles seaward.
- **Provincial Government** has jurisdiction to explore, utilize, and manage coastal and marine resources located within an area from 4 nautical miles up to maximum 12 miles seaward.

**A HISTORICAL DEVELOPMENT OF COASTAL MANAGEMENT  
IN INDONESIA**

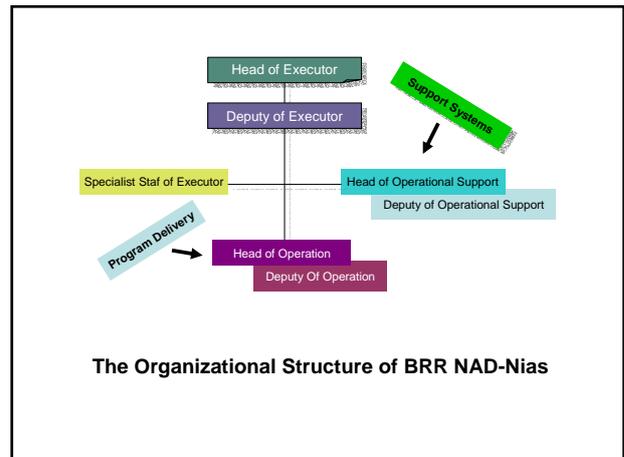
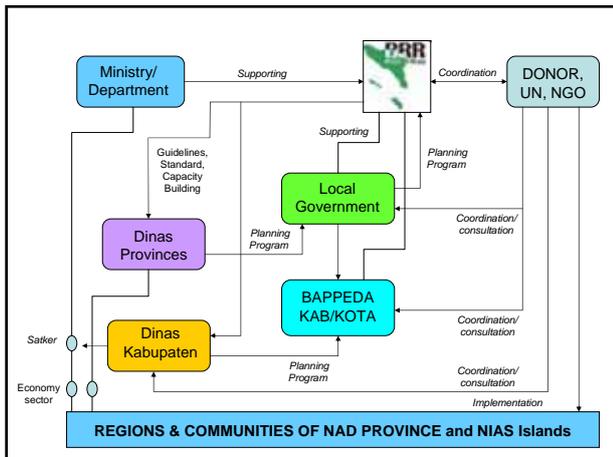
- **Despite the fact that Indonesia is the largest maritime and archipelagic state on earth (in terms of sea space and resources)**, the first government document which emphasizes the strategic value of coastal and marine resources for the advancement and prosperity of the nation including policies and programs to materialize such a potential was **the 1993 GBHN** (State Policy Guidelines).
- **During 1993 to September 1999** (before the establishment of MMAF), **CZM** efforts in Indonesia were mostly academic exercises which were driven by bilateral and multilateral development loans or grants, international NGO's, or Indonesian universities and research institutes. Examples:
  - ICZM of Segara Anakan Lagoon, Cilacap, Central Java (ADB, 1986)
  - ICZM of Bunaken National Park (USAID and Min. of Forestry, 1989)
  - ICZM of Lampung, East Kalimantan, and North Sulawesi provinces (USAID, 1995 – 2004)

- **Consequently**, most CZM programs before the Reform Era (the establishment of MMAF) were like **'a paper CZM'** (**'a toothless tiger'**). Therefore, issues such as unclear, absent, or overlapping policies and regulations over coastal development and management were continue, which brought about **spatial and resource use conflicts, uncertainties for investment and business, and inefficiencies**. In addition, **slow and low yielding economic sectors** perceived by decision makers (e.g. capture fisheries, aquaculture, agriculture, forestry and let a lone conservation areas) were mostly displaced by **quick and big yielding economic sectors** (e.g. mining and energy, real estates, and industrial estates).
- **Since the establishment of MMAF** equipped with a special Directorate General for Coastal and Small Island Management, the implementation of ICZM has been improving. Examples:
  - ICZM of MCRM Program in 15 provinces and 52 regencies/cities.
  - ICZM of coral reef ecosystems under COREMAP in 6 provinces and 12 regencies.

**COASTAL ZONE MANAGEMENT IN TSUNAMI'S AFFECTED  
AREAS (ACEH AND NIAS ISLANDS)**

- **After the Emergency Response Phase (24 December 2004 – 26 March 2005)**, President of Republic of Indonesia (Perpu Act No.2/2005) establish the BRR for a time frame up to 2009 with four major missions:
  1. Redevelop Aceh and Nias communities socio-cultural life as an individual and as a society.
  2. Reconstruct physical and institutional infrastructures.
  3. Redevelop the economy of Aceh and Nias.
  4. Redevelop Provincial, Regency/City Government to ensure better and more efficient public services.

- **The BRR (The Executing Agency)** supported by the Steering Committee and The Supervision Committee is responsible for planning and implementation of all rehabilitation and reconstruction projects and programs.
- **Total budget allocated for rehabilitation and reconstruction of Aceh and Nias from April 2005 to April 2009 is Rp 60 trillions (US\$ 7.5 billions)**. On top of this, are from donor agencies and NGO's.
- **Programs and projects funded by the GOI's budget are implemented by the BRR; while those projects funded by donor countries and NGO's should be under the coordination of BRR.**



### V. LESSONS LEARNED AND RECOMMENDED SOLUTIONS

1. Establish disaster management as a national policy and equipped with a national agency which is responsible for implementing such a policy.
2. To mitigate the adverse impacts of tsunami, the tsunami management (in the context of the national disaster management) should be embedded in ICZM of every regency/city and province which is prone to tsunami threats.

### 3. Program Components and Mechanisms of Tsunami Management within the ICZM Framework are as follows:

1. Establishment and operation of Tsunami Early Warning System.
2. Non-structural counter measures.
3. Structural counter measures.
4. Tsunami research and development.
5. Social-economic and institutional measures for sustainable coastal development.
6. Enactment of national disaster management law.

### 5.1. Establishment and operation of Tsunami Early-Warning System

The basic principles of the Indonesian TEWS are as follows :

- Issue warning within 5 minutes
- Real time, automatic, and compatible with national and international standard
- The components are : observation and integration of data; dissemination of information; and community preparedness.

### 5.2. Non-structural Counter Measures

- Public awareness; Education, training and awareness building, dissemination media, and various public campaign activities
- Development of Spatial Use Planning Models for Provinces, Districts, Cities and Small Islands
- Development of National Policy and Guidelines (Coastal and Small Islands Hazards Mitigation, Integrated Coastal Zone Management, and Indonesian Coastal Management Act)
- Marine and Coastal Resources Management Program

### 5.3. Structural Counter Measures

- Tsunami countermeasures using hard structure (seawall, breakwater, etc)
- Evacuate the people who lives in the dangerous area
- Using soft structure might be recommended in this case, such as mangrove green belt, coastal forest, and land use arrangement

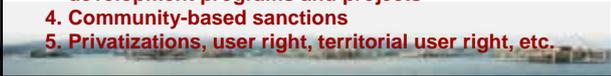


### 5.4. Tsunami Research and Development

- Research is fundamental to build tsunami disaster mitigation strategies
- Research agendas ; multidisciplinary, comprehensive knowledge about disaster, impacts to societies and communities interact

### 5.5. SOCIO-ECONOMIC AND INSTITUTIONAL MEASURES FOR SUSTAINABLE COASTAL DEVELOPMENT

- \* Performance indicators of President, Governor, or Mayor should include not only economic growth, but also social equity and ecological sustainability of the coastal zone.
- \* Enhancing the carrying capacity of the coastal zone through technology and trading.
- \* Controlling development intensity (the utilization rate of natural resources and environmental services) which does not exceed the carrying capacity of the coastal zone:
  1. Command and control
  2. Economic incentives (market mechanisms)
  3. Extended Benefit-Cost Analysis for the feasibility of development programs and projects
  4. Community-based sanctions
  5. Privatizations, user right, territorial user right, etc.



### 5.6. Disaster Management National Law, Indonesia's New Beginning

The outline of the Disaster Management Bill is as follows :

- Shifting from emergency response to disaster risk reduction.
- Shifting of protection from a privilege of a few to protection as a human right
- Shifting disaster management from government's business to the business of all

The disaster management bill would require among others:

- a) Enforce regular hazards identification, assessment, and monitoring;
- b) Mitigate the hazard of disasters;
- c) Ensure the preparedness of community and emergency responders;
- d) Make the necessary arrangements to enable surge capacity of emergency response both nationally and internationally; and
- e) Take reconstruction and rehabilitation as an inseparable part of the disaster management

