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Wisdom of Land and Water Management Framework on Bali and Strategic Adaptation towards Climate Change

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Outline

1. Water Resource Systems and IWRM
2. Water Resource Management and the Principle of Sustainability
3. Security of Water Resources and IWRM
4. Climate Change and Adaptation for Water Security
5. Nakagami's Concern to the Bali Project
6. 「Wisdom of Land and Water Management(水土の知)」: 7 View Point for Bali Project
7. Discussion Points

1. Water Resource Systems and IWRM

Given the severely degraded status of the water resources, it will be impossible to resolve extant problems merely by implementing conventional policies, such as decreasing water pollution loads and better observance of environmental water standards.

- Jain and Singh (2003) refer to a water resources system as an aggregation of water resource elements that are united by interrelationships between parties that have similar objectives, implying that such systems have physical, engineering, social, biological, legal, geographical, and agricultural characteristics.

Functions of the Water Resources Systems

Subsistence Functions

Local communities make use of water and water based products which are not marketed

Commercial Functions

Public or private enterprises make use of water or water based products which are marketed or otherwise given a monetary value

Environmental Functions

Regulation functions, non-consumptive use

Ecological Values

Values of water resources systems as an ecosystem

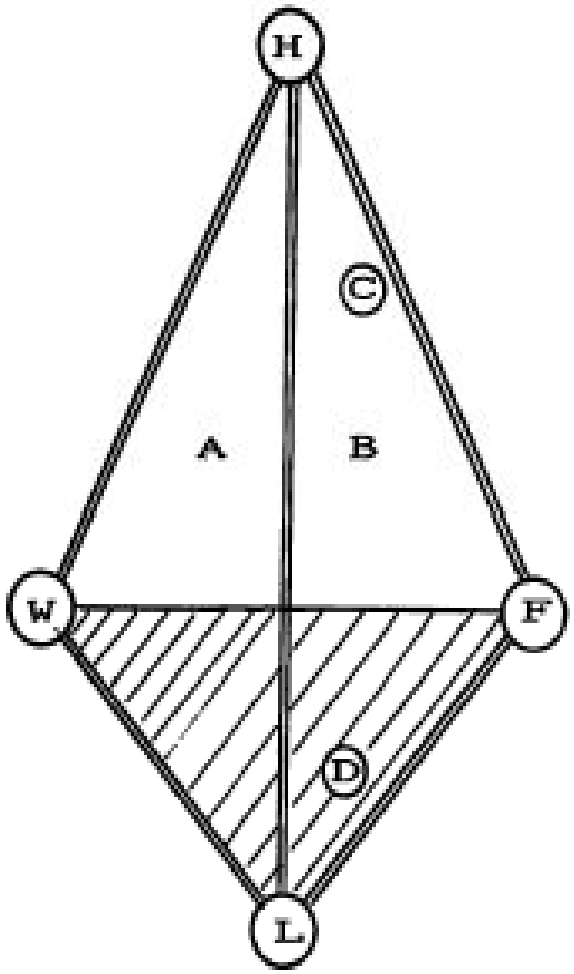


Figure1Structural model of basin areas

A: Water resource-use dimension:

The interaction among [H], [W], and [L]

(e.g., the effects of land-use activities on the quantity and quality of water resources)

B: Forest conservation dimension:

The interaction among [H], [F], and [L]

(e.g., the effects of land-use conversion from forest to other uses on the basin environment)

C: Watershed development dimension:

The interaction among [H], [W], and [L]

(e.g., the effects of water developments on run-off)

D: Water resource-use dimension:

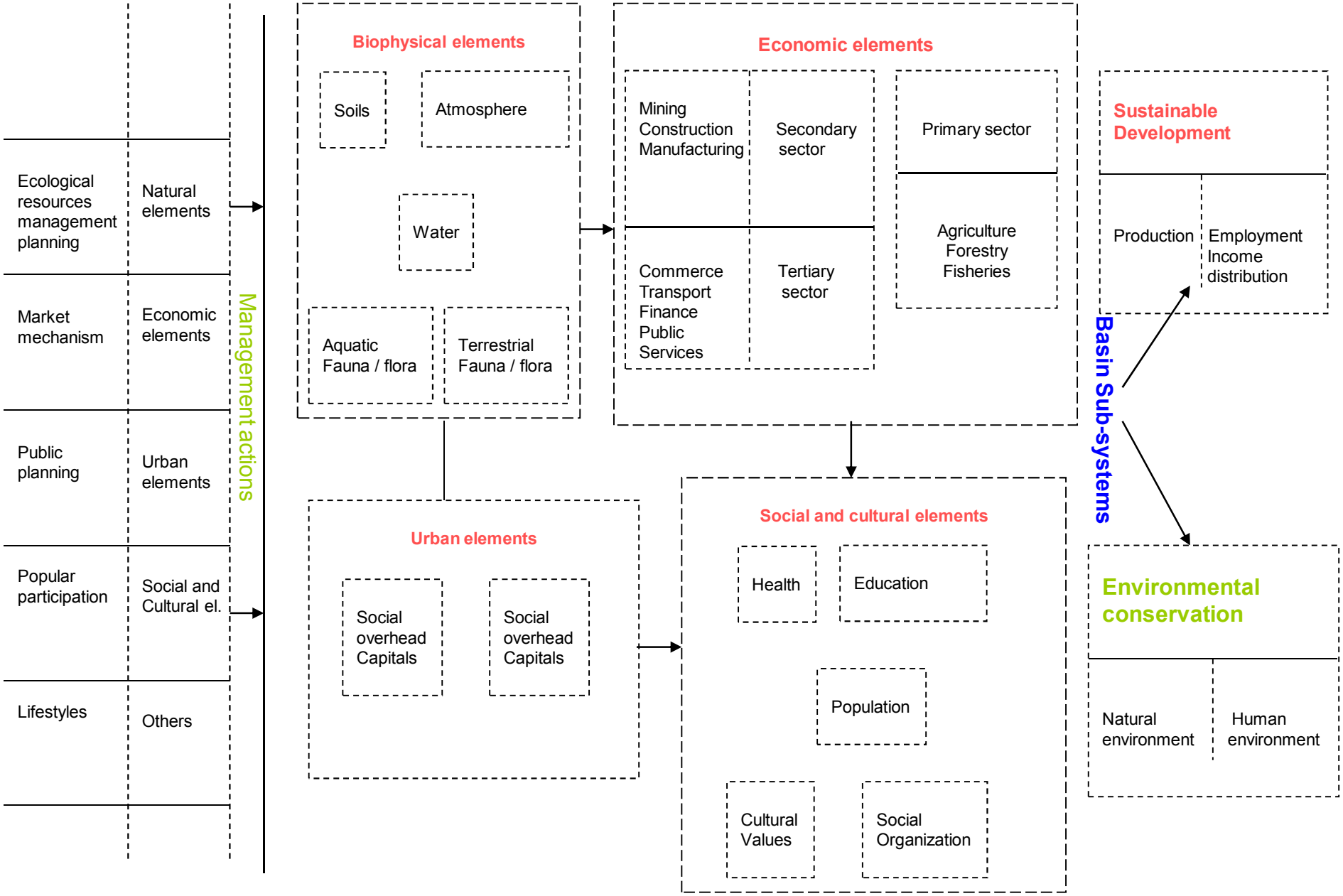
shown as the natural processes of a basin areas represented by three major elements, i.e., [L], [W], and [F]

Table 1 A Framework of Environmental Resources

Environmental Management / Environmental Resources(ERs0	Environmental Improvement	Environmental Conservation	Environmental Creation
Natural / Ecological ERs	Natural disasters Soil pollution	Biosphere Natural landscape	Env'tal carrying capacity
Production activity-oriented ERs	Air pollution Water pollution Wastes	Lithosphere Water-sphere Atmosphere	Local energy
Urban activity –oriented ERs	Noise, vibration Odor Land subsidence	Spatial organization	Aesthetic resources
Socio-cultural ERs	Neighborhood pollution	Historical and cultural resources	Amenities and services

*Factors and elements to be taken into consideration in basin management can be categorized in accordance with the framework of environmental resources.

Figure 2 Management Action in the Basin Sub-systems



- Management actions for each sub-system should be directed to the following:

(a) Biophysical elements

Conservation of environmental integrity and carrying capacity of basin on the basis of ecological principles

(b) Economic elements

Management of interactions among economic elements through market mechanism for achieving viable economic performance, efficient resource allocation and proper industrial mix

(c) Urban elements

Promotion of social overhead capital formation and urban development

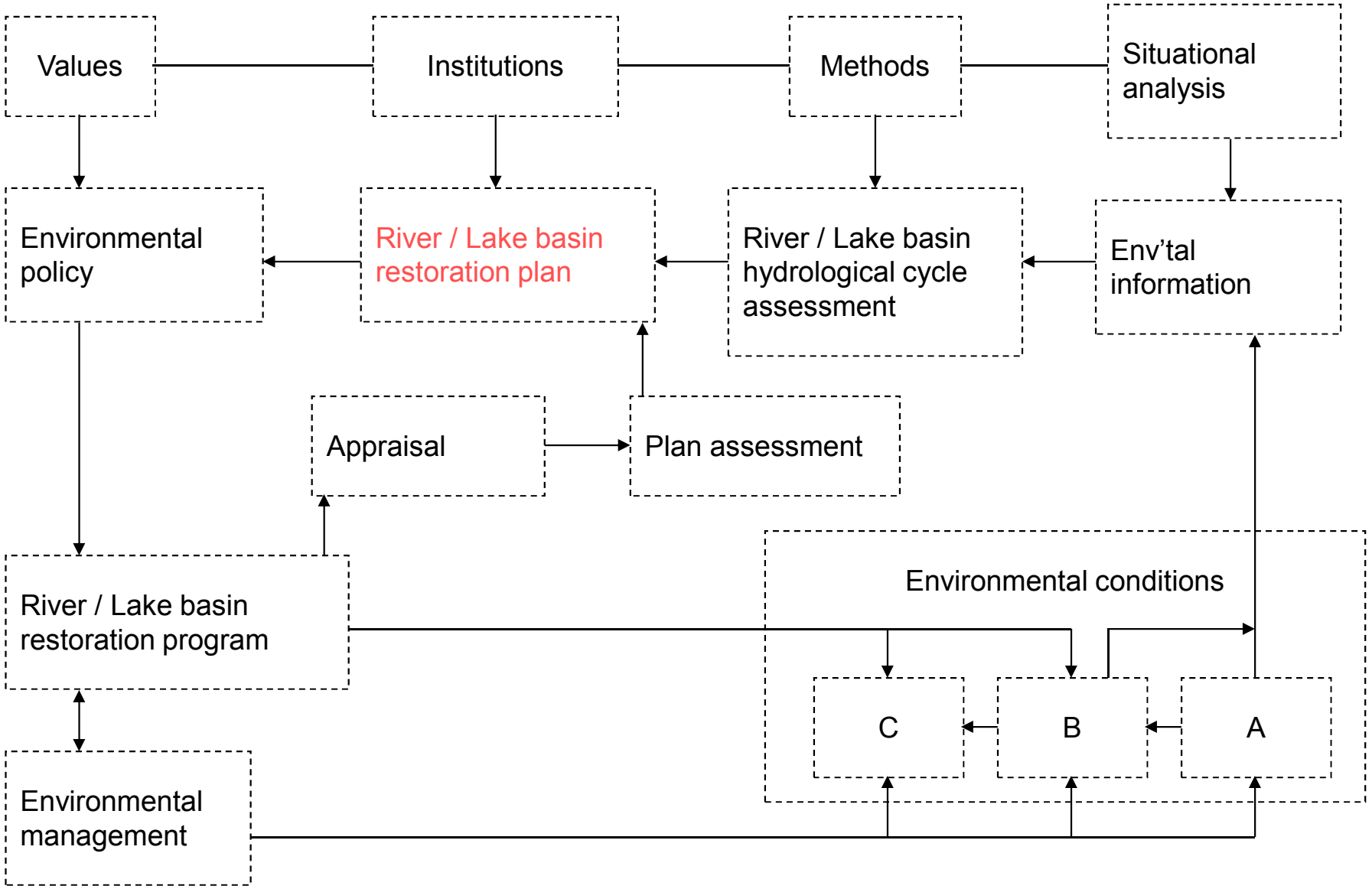
(d) Sociocultural elements

Formation of viable social organizations through popular participation towards promoting health and education among basin community members and enhancing the value of basin community specific culture

(e) Others

Management of environmental resources other than the above elements through change of lifestyles

Figure3 A Generalized Framework for Environmental Management in a River / Lake Basin Context



- IWRM is the key approach towards these ends and requires a shift from fragmented water resource management by different ministries and sectors, toward cross-sectoral integration in policy development for effective water management.
- The program of IWRM would thus provide, if successful, a new framework for **basin-wide water governance for water security**, and the **community-based resource management** at its base exhibits itself as efforts to achieve human security by way of **capacity building** of community members.

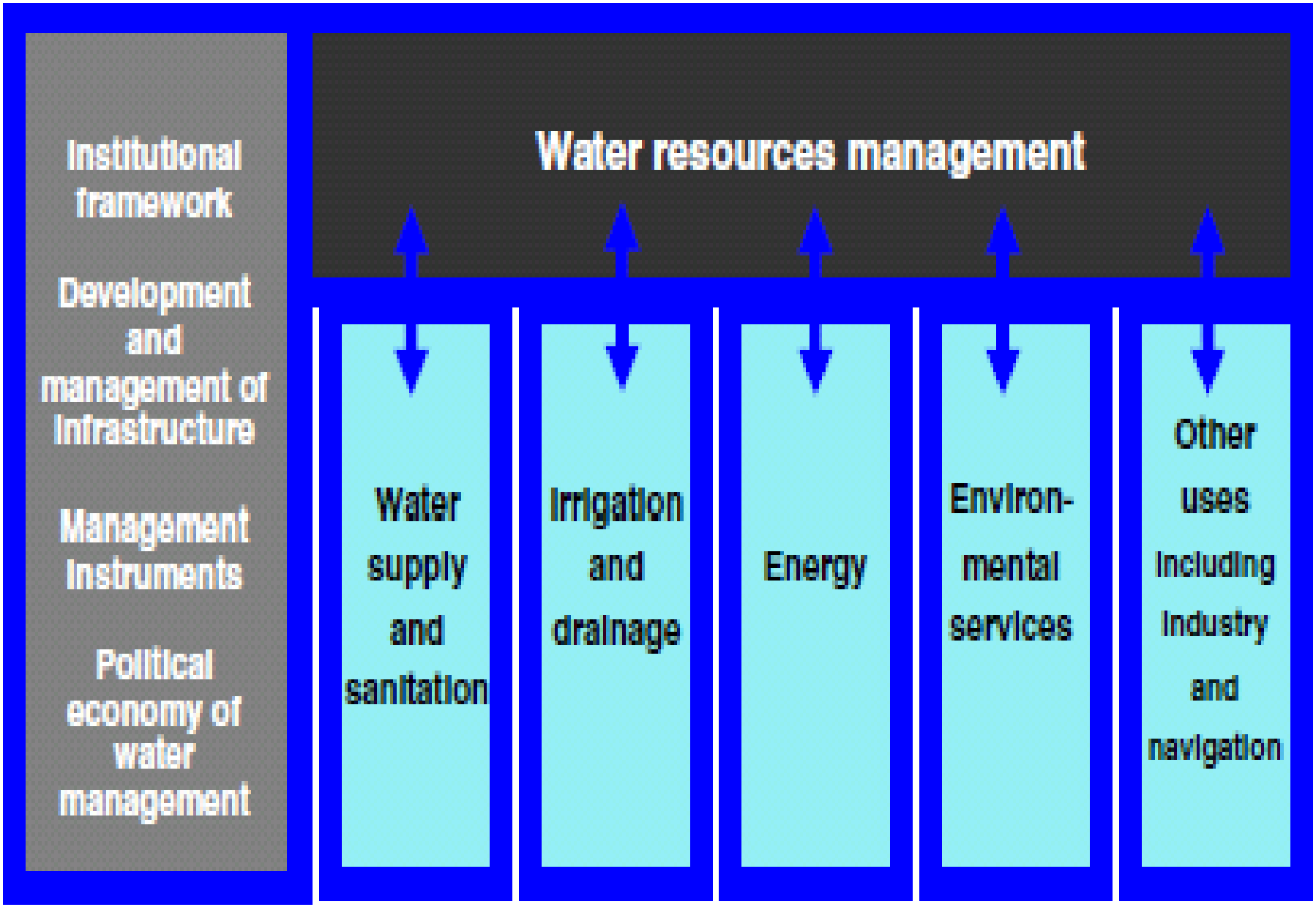


Fig. 1. Strategy for water resources management from World Bank (2004).

Integrated Water Resources Management Activity List

1. Establish regional & catchments goals
2. Comprehensive information base
3. Projecting future conditions
4. Governance
5. Strategy development
6. Environmental integration
7. Operating practices
8. Strengthen local capacity to implement IWRM

2. Water Resource Management and the Principle of Sustainability

- Water is a fundamental necessity for economic development and ecosystems as well as a vital resource for human beings. However, it's sustainability is not clearly clarified, even today .
- The argument regarding sustainability in the water sector has been developed in view of "the balance between demand and supply in the sense of ensuring that socio-economic system does not deteriorate (Loucks and Gladwell 1999)".
- Dixon and Fallon determined that sustainability of water resources management consisted of the following:

  "A series of activities which ensure the social value of services supplied from set water resources system will fulfill present social objectives without losing capacity to satisfy future generations' objectives" (Dixon and Fallon 1989).

- The main principle of sustainability, as it applies to water resource management can clearly be stated as, *"The extraction from both underground and groundwater resources should not exceed the ability to regenerate those resources and compromise bio-diversity in the ecosystem"* (ESCAP 1997).
- Water resource institutions are not only required to fulfill an institutional role that is capable of managing multipurpose water resources management plans, they must also ensure that needs related to development, equity, environmental quality, and sustainability are met (Hufschmidt and McCauley 1990).

3. Security of Water Resources and IWRM

- The concept of water security is currently being formulated in line with security concepts in sectors other than traditional defense and diplomacy.
- The concept of water security is defined as the "foundational and institutional maintenance of water resources and environmental security in urban areas".
- This indicates that arguments related to water issues have entered areas that are not sufficiently well understood from hydrological or "human beings and water culture" perspectives.

IWRM and Water Security

WATER SECURITY FRAMEWORK

(STAGE:UD,DEVELOPED,CLIMATE CHANGE)

NATURAL & ECOLOGICAL

NATURAL(LAND,ECOSYSTEM)
METEOLOGIACL(CLIMATE CHANGE)
WATER BALANCE(HYDROLOGIC CYCLE)

TECHNOLOGICAL &SCIENTFICAL

PLANNING(URBAN & WATER ENVIRONMENT USE)
WATER SYSTEM(WATER SUPPLY & DEMAND,FLOOD)
INNOVATION (TECHNOLOGY & INSTITUTION)

SOCIAL & CULTURAL

ECONOMICAL(ECONOMIC & INDUSTRIAL POLICY)
FINANCIAL(BUDGET & FINANCE)
HUMAN CAPABILITY(GWP,TRAINING PROGRAM)

Establishing a water-security society has become crucial, and the participation of civil society will play a critical role in achieving water saving goals.

Long-term endeavors to raise public awareness and joint efforts by various stakeholders on legal, political, institutional, managerial and technical aspects are necessary.

4. Climate Change and Adaptation for Water Security

Past data and experience would not be practically useful (The IPCC 4th Assessment Report)

Climate change would cause large-scale sea level rise, more intense storms and typhoons, and more serious droughts.

Areas where disaster mitigation systems have been made based on past meteorological data and experience would possibly suffer even more devastating damage due to increases in scale and frequency of flood, sediment-related, storm-surge and other disasters, including serious droughts.

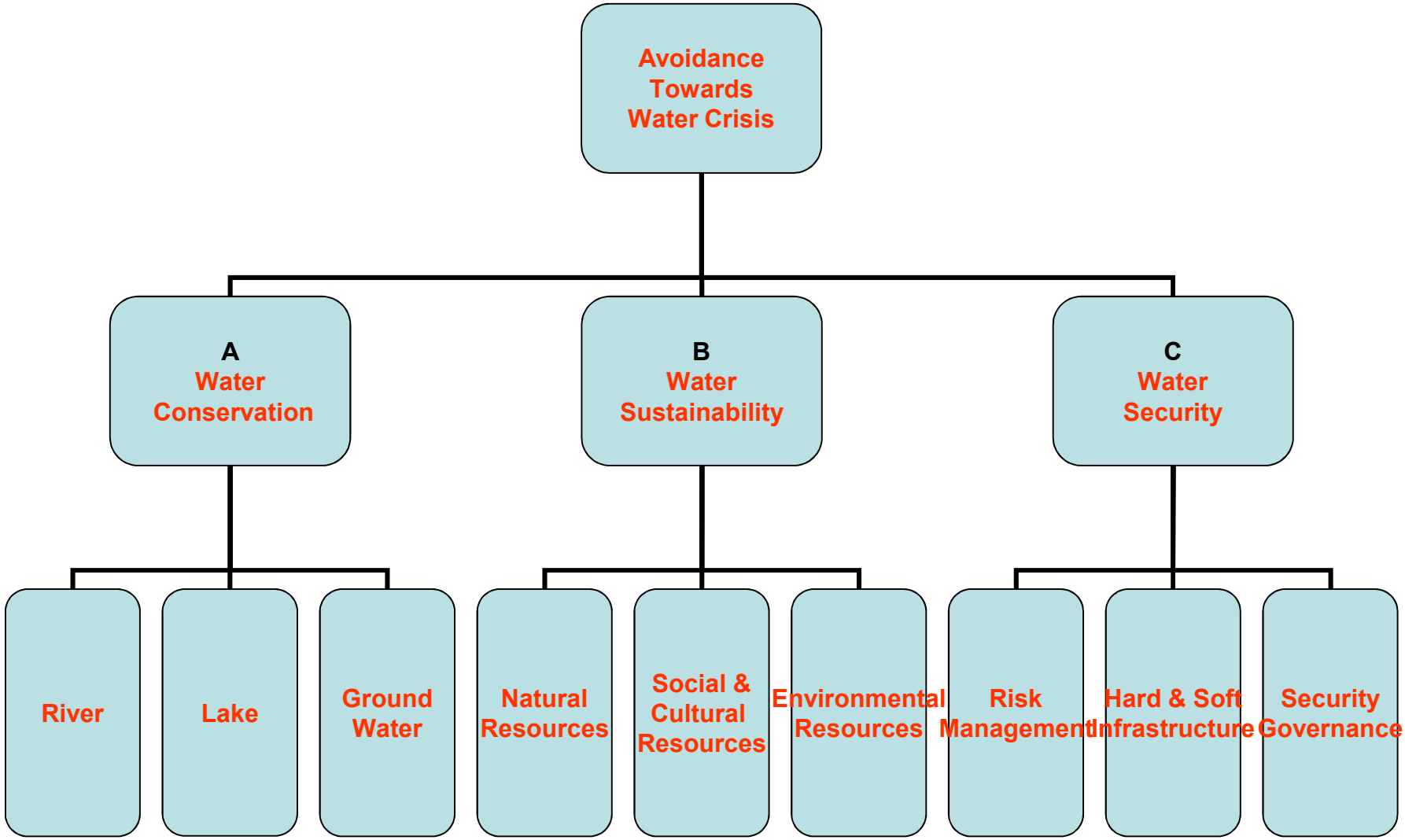
Proposing effective adaptation strategies

- **Discussion from the viewpoints of rationality, efficiency and effectiveness is needed.**
- **Possible impacts of climate change need to be closely reviewed** to **minimize damage by avoiding extreme destruction.**
- **Adaptation strategies should be planned to cover various subjects**, such as the national land and society, in terms of flood control, water use and river environment by revising issues and problems of existing structures for such use

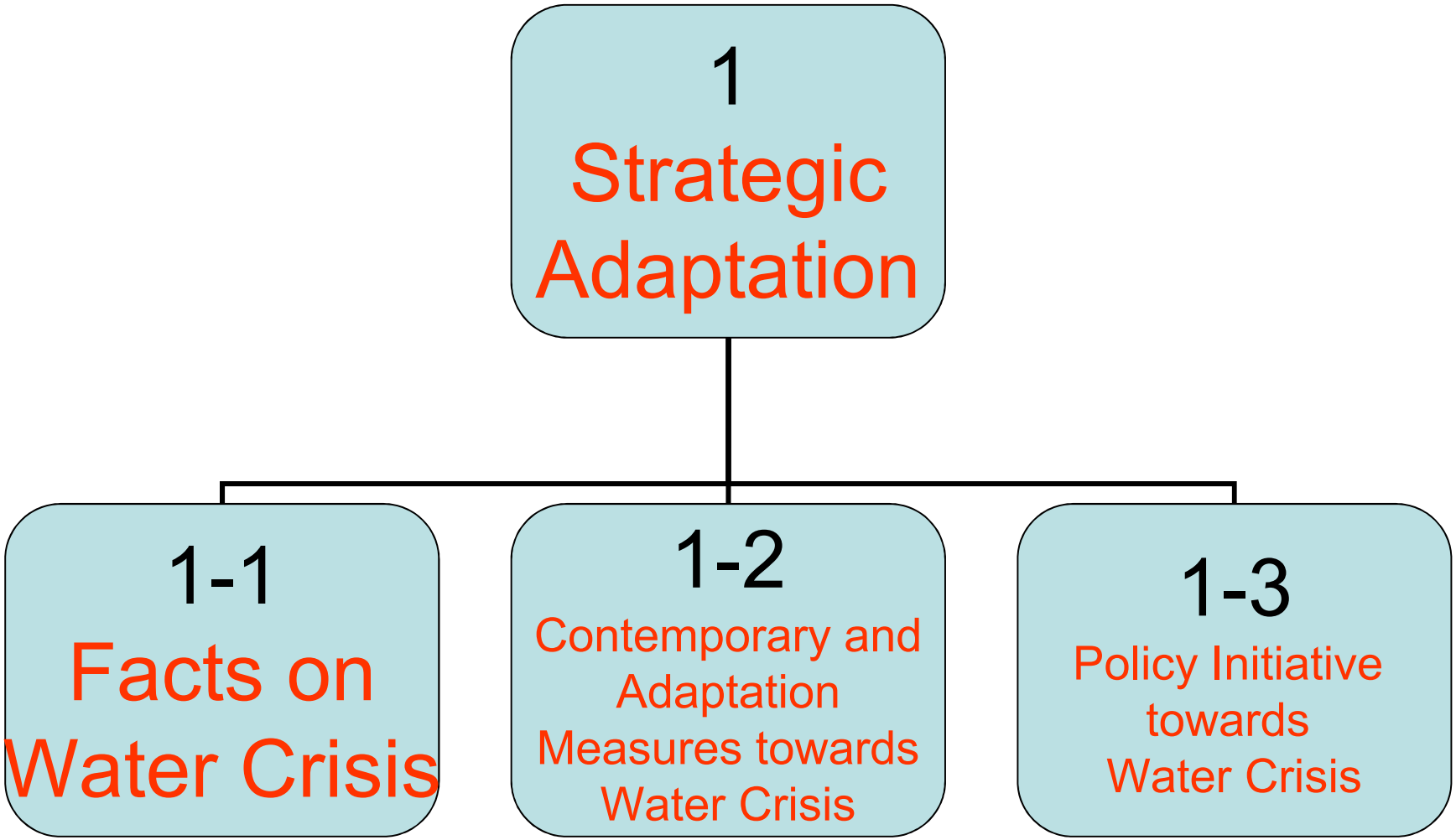
- It is important to **be aware of uncertainty** in climate change projection and to make efforts to improve the projection accuracy.

Introducing a flexible approach

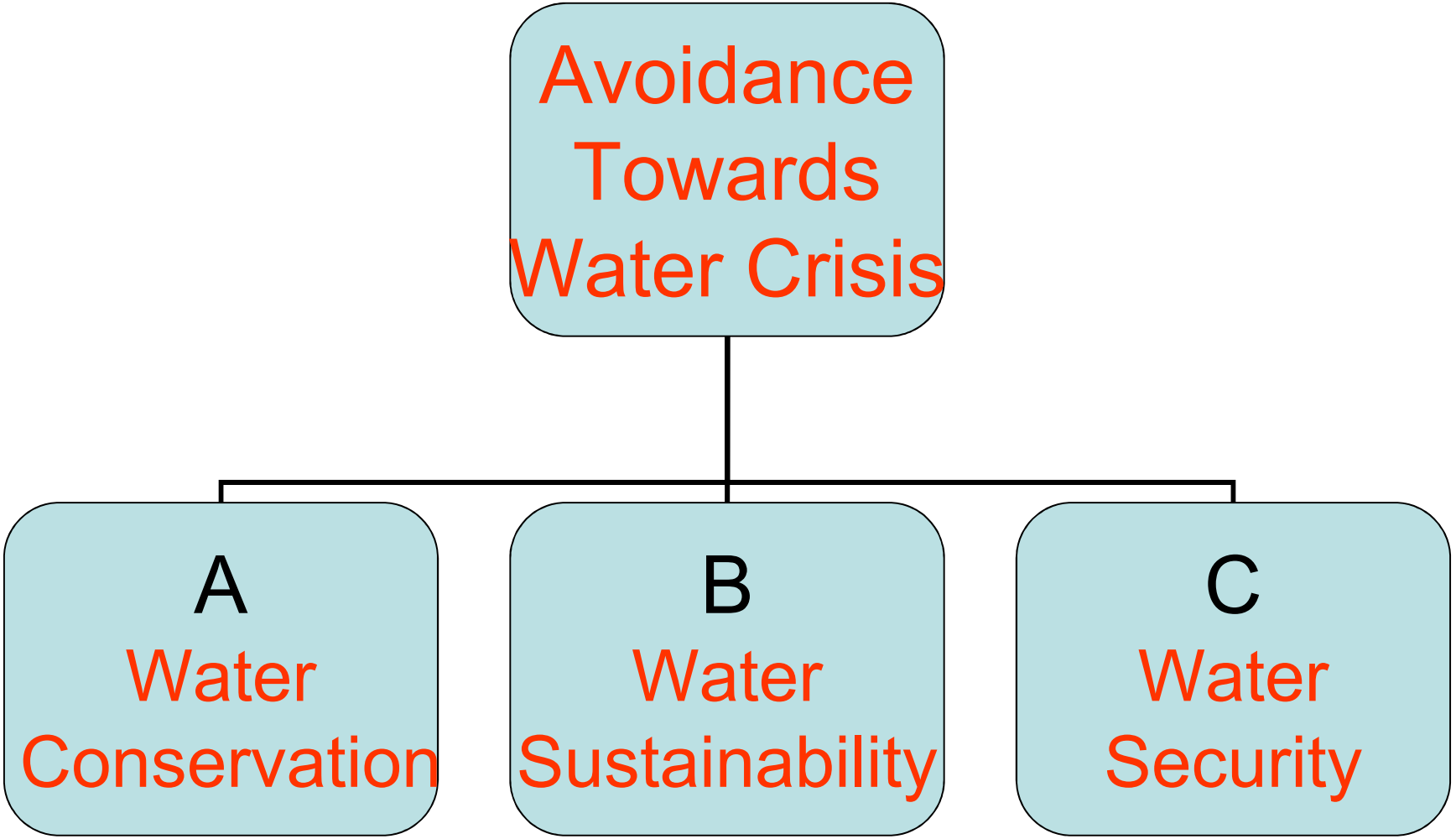
- Adaptation measures should be planned using a “flexible” approach
- It is necessary to devise appropriate adaptation plants best suited for the time based on the improved projection.
- Thorough consideration should be paid to social conditions and land use change and also to circumstances related measures for flood control and water use.


Avoidance Towards Water Crisis
A Water Conservation
B Water Sustainability
C Water Security
River
Lake
Ground Water
Natural Resources
Social & Cultural Resources
Environmental Resources
Risk Management
Hard & Soft Infrastructure
Security Governance

Strategic Adaptation towards Water Crisis



Strategic Adaptation towards Water Crisis



Framework of Water Adaptation

- Adaptation Option/Strategy
- Increasing of Intake from the Rain
- Storage of Water and Maintenance Technique
- Reutilization of Water
- Purification of Water
- Efficient of Water Utilization and Irrigation
- Basic Policy Framework
- Water Resources Policy
- IWRM
- Water Disaster Management
- Main Subjective Conditions and Opportunity
- Budget, Human Resources, Physical Obstacle, IWRM,

Challenges faced by more and more countries in their struggle for economic and social development are increasingly related to water.

Water shortages, quality deterioration and flood impacts are among the problems which require greater attention and action.

Integrated Water Resources Management (IWRM) is a process which can assist countries in their endeavor to deal with water issues in a cost-effective and sustainable way.

5.Nakagami's Concern for Bali Project

1. To establish Asian IWRM based on the Wisdom of Land and Water Management

Ⅰ. Research Area

Saba river、Kabupatan Buleleng、Basin Area128.4 km2

Ⅱ. Research Objectives

- To analysis the flexible Adaptation Process concerning about the sustainability in the Subak system , which is confronted the landuse change and damaged irrigation facility caused by flood.
- To examine the landuse regulation and irrigation coordination related to flood control and water resources development in the Saba river.
- To propose Comprehensive IWRM based on the Wisdom of Land and Water Management, which consider the sound livelihood , environmental conservation and climate change.

6.「Wisdom of Land and Water Management(水土の知)」: 7 View Point for Bali Project

--See Through

- What is a Natural Resources Utilization Potential in Bali?
- **Use Up**
- To Use up water resources ,farm products and water terrace as regional resources

--Make Sure

- To evaluate factors which is examined present dam and agricultural influence caused by climate change
- **Set Great Value**
- **All components (Agricultural System , Service, Agri Business)in Bali**
- Get a Tryout
- **Maintenance and Management of Water Terrace**
- **Foresee**
- **The Relationship between Bali and World Bank , ADB and Indonesia Central Government**
- **Live Together Happy**
- **The Change of Local Inhabitants Consciousness**


CAT
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Good Reference

Synthesis Report

Risk and Adaptation Assessment to Climate Change in Lombok Island, West Nusa Tenggara Province

gtz

Table 1.1 Various Levels of Risk and Adaptation to Climate Change

Study Levels	Data/Analysis Needs	Study Scope	Planning Levels	Accuracy	Expenditure
Macro	Qualitative	National	Adaptation policies	Low	Low
Meso	Combination of qualitative and quantitative	Province	Adaptation strategies	Moderate	Moderate
Micro	Quantitative	Local	Adaptation measures	High	High

Source: modification from Messner (2005) in Suroso (2008)

Figure 2.2 Graphs of monthly average composite rainfall (left) and temperature (right) based on observational data from Selaparang/Ampenan stations for the baseline period 1961-1990 (blue) and 1991-2007 (red). The vertical line (error-bar) indicates standard deviation.

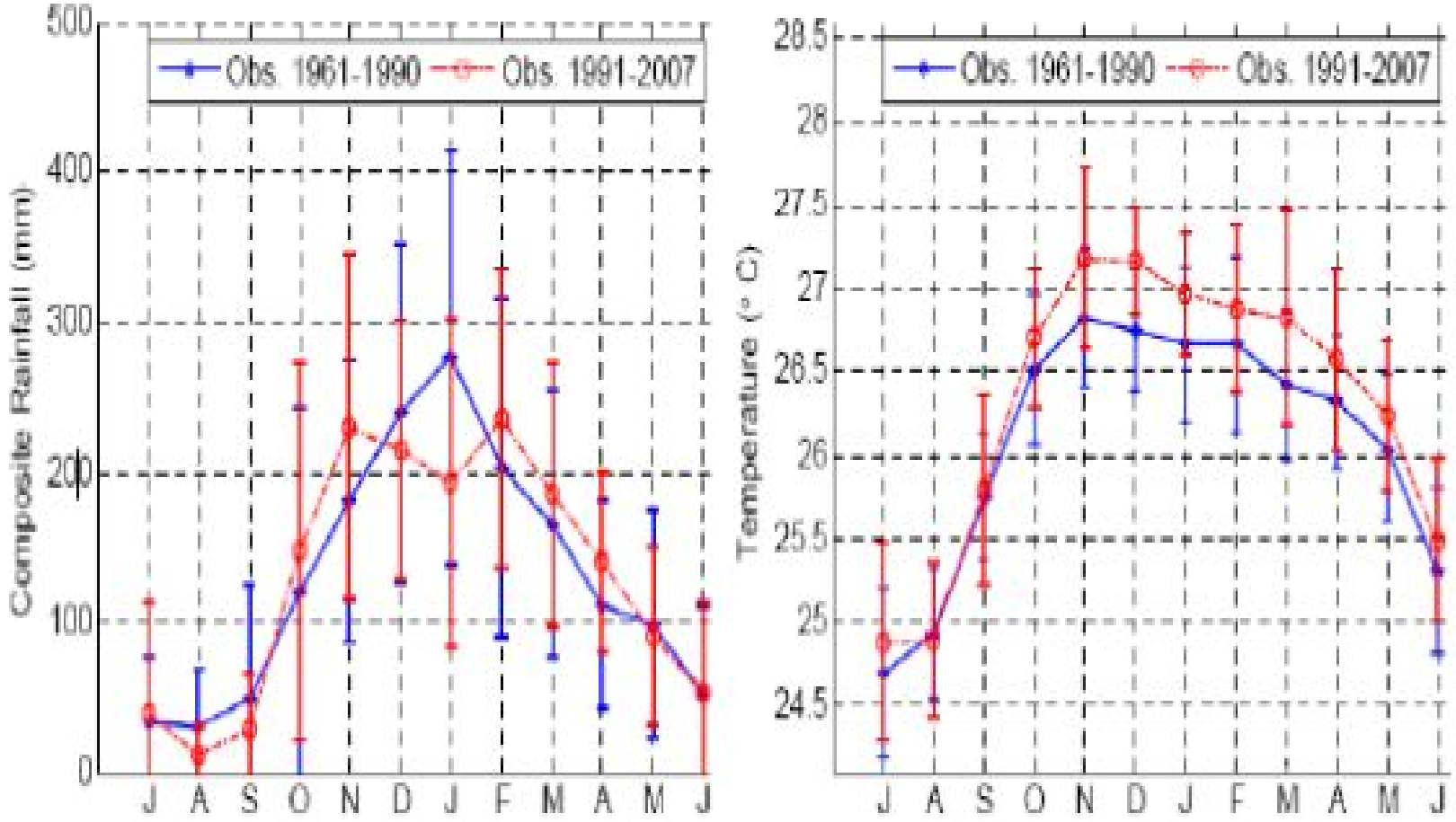


Figure 2.6 Estimated sea level - North coast of Lombok Island

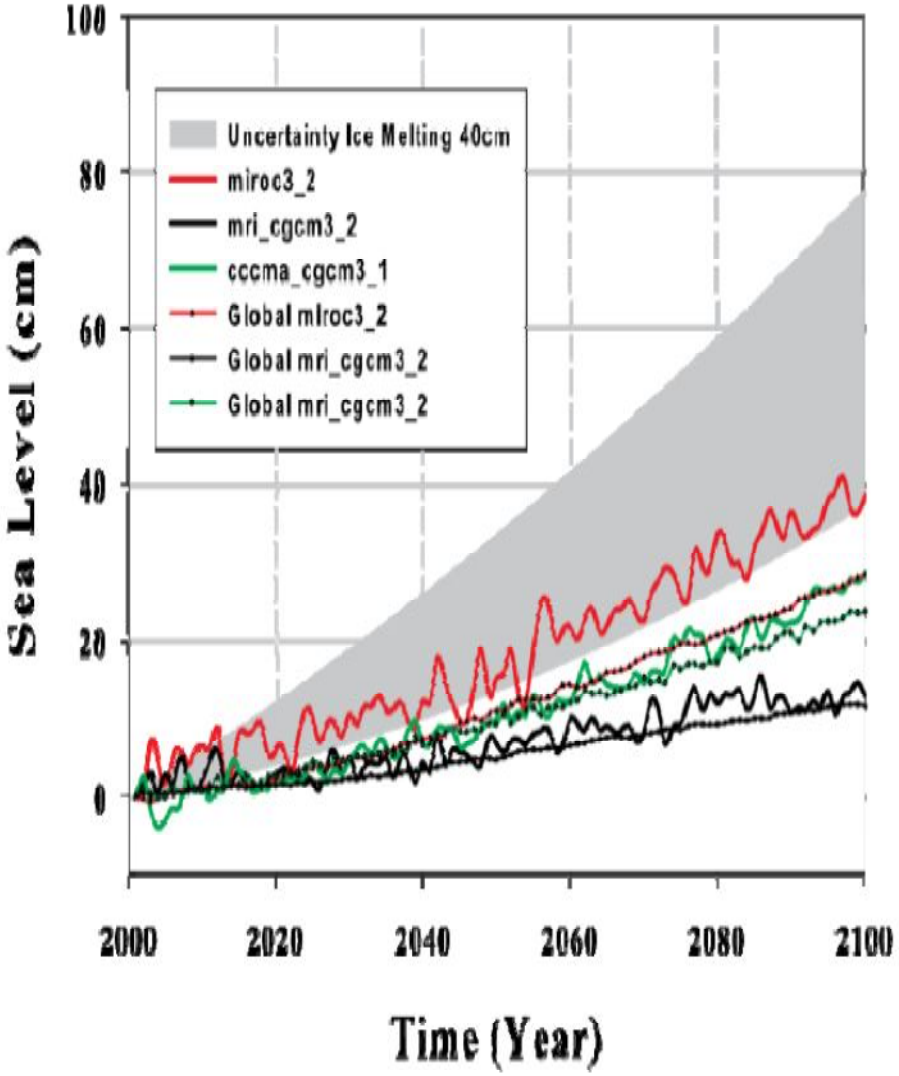


Figure 2.7 Estimated sea level - South coast of Lombok Island

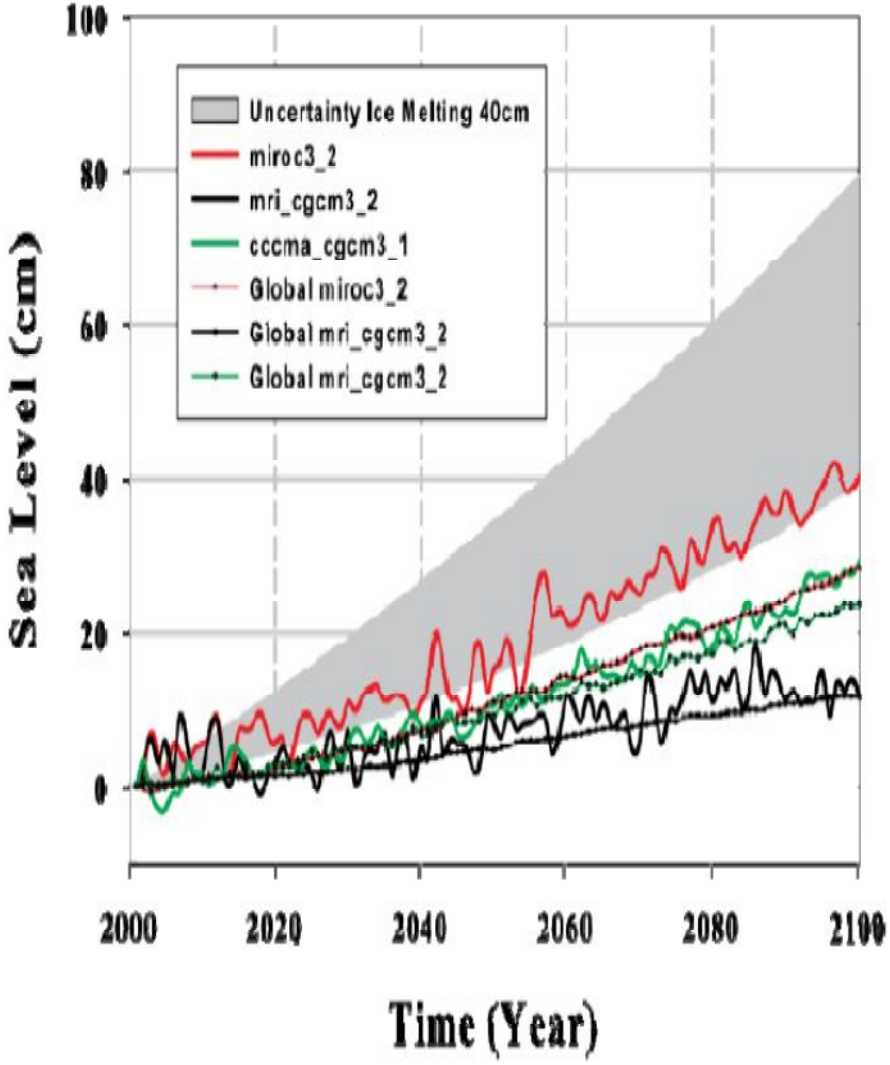
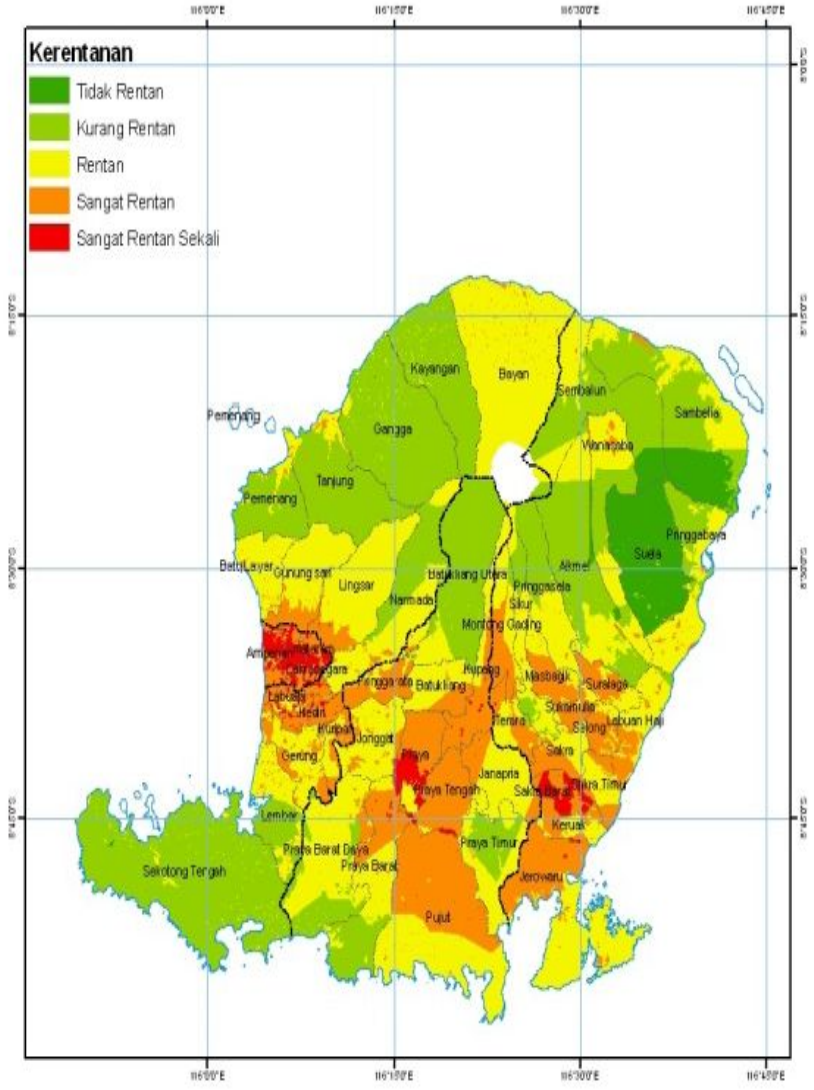


Table 3.1 Components of water sector vulnerability to climate change

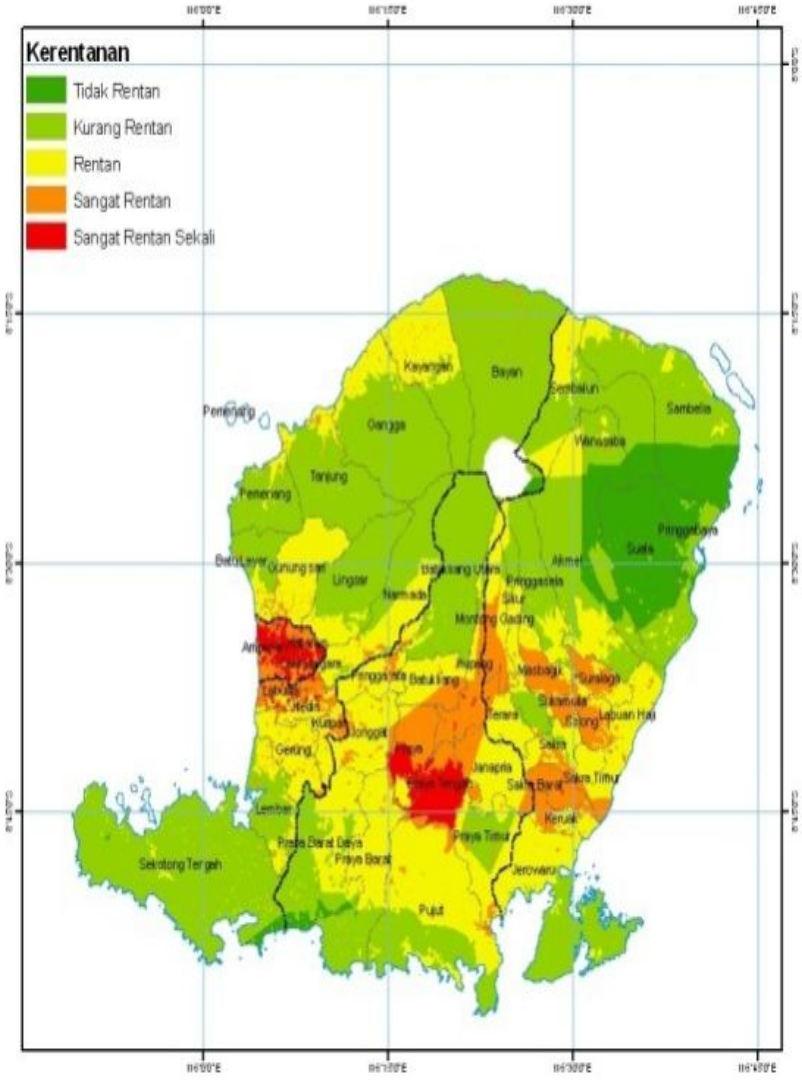
POTENTIAL H	HAZARD (H)	Water Sector Vulnerability (V)	
		Comp	Type
Changes in the rain pattern, increase in T, SLR, immersion	Decreased Water supply	E	1. Population density (spatial)
			2. Land use (spatial)
		S	1. Water needs
			2. Type of soil / rock (spatial)
			3. Rainfall distribution pattern (spatial)
		AC	1. Population welfare(spatial)
			2. Irrigation infrastructure
	Flood zone	E	1. Population density (spatial)
			2. Land use (spatial)
		S	1. Criticality level of SSWS areas
			2. Criticality level of protected forest area
			3. Rainfall distribution pattern (spatial)
		AC	3. Population welfare(spatial)
			4. Irrigation infrastructure
	Drought	E	1. Population density (spatial)
			2. Land use (spatial)
		S	1. Water needs
			2. Rainfall distribution pattern (spatial)
			3. Criticality level of protected forest area
			4. Land slope (spatial)
		AC	1. Population welfare(spatial)
			2. Irrigation infrastructure

Notes: *H: hazards, Pot: potential, T: temperature, SLR: sea level rise, Comp = vulnerability component; E: exposure, S: sensitivity, AC: adaptive capacity, spatial:* types of information with more-detailed accuracy levels or spatial-units

Figure 3.3 "Vulnerability to Flood Hazard" map for Lombok Island: a. with welfare component b. without welfare component.



a.



b.

Figure 3.6 Flood risk map for 2030-2080 period

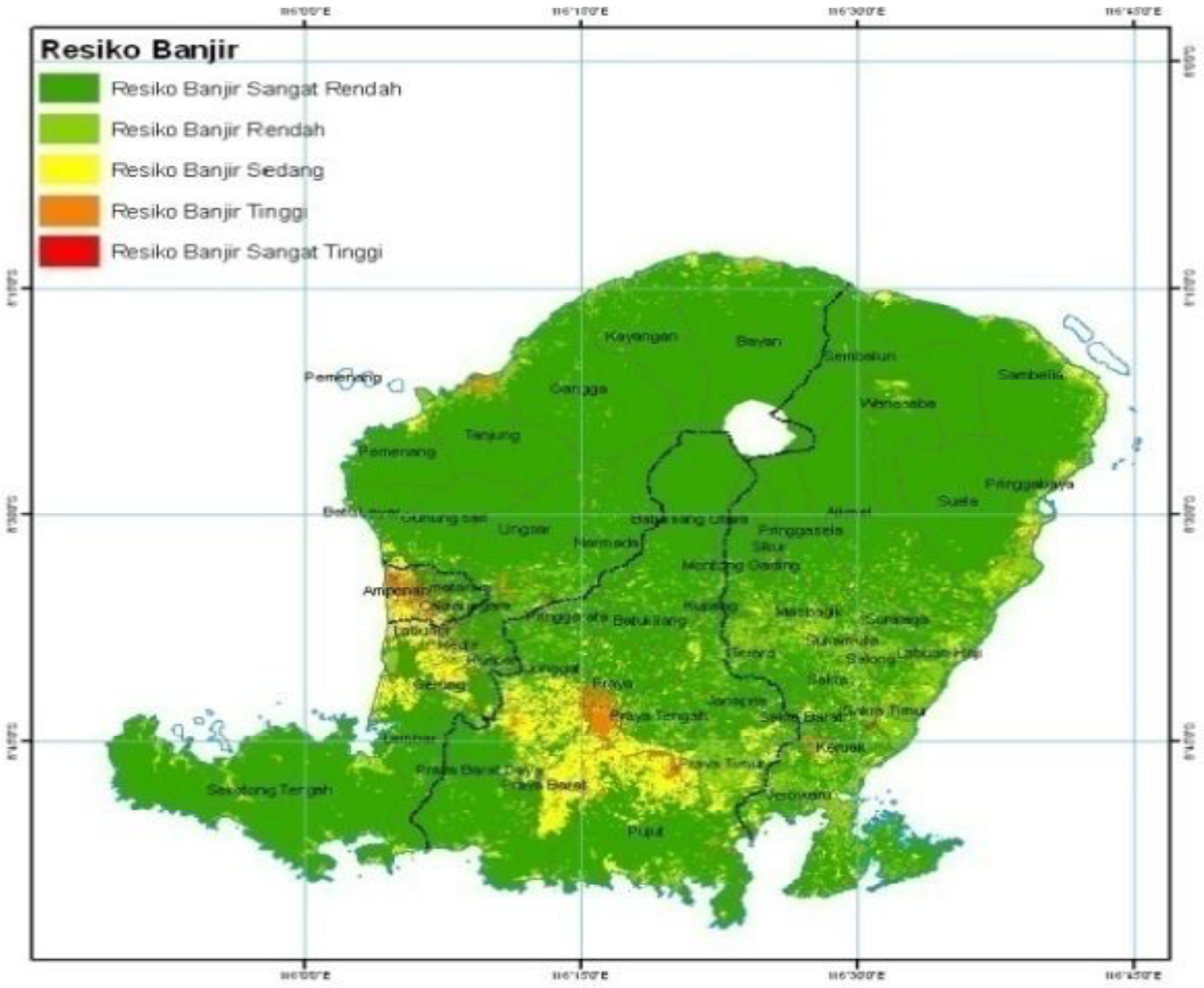
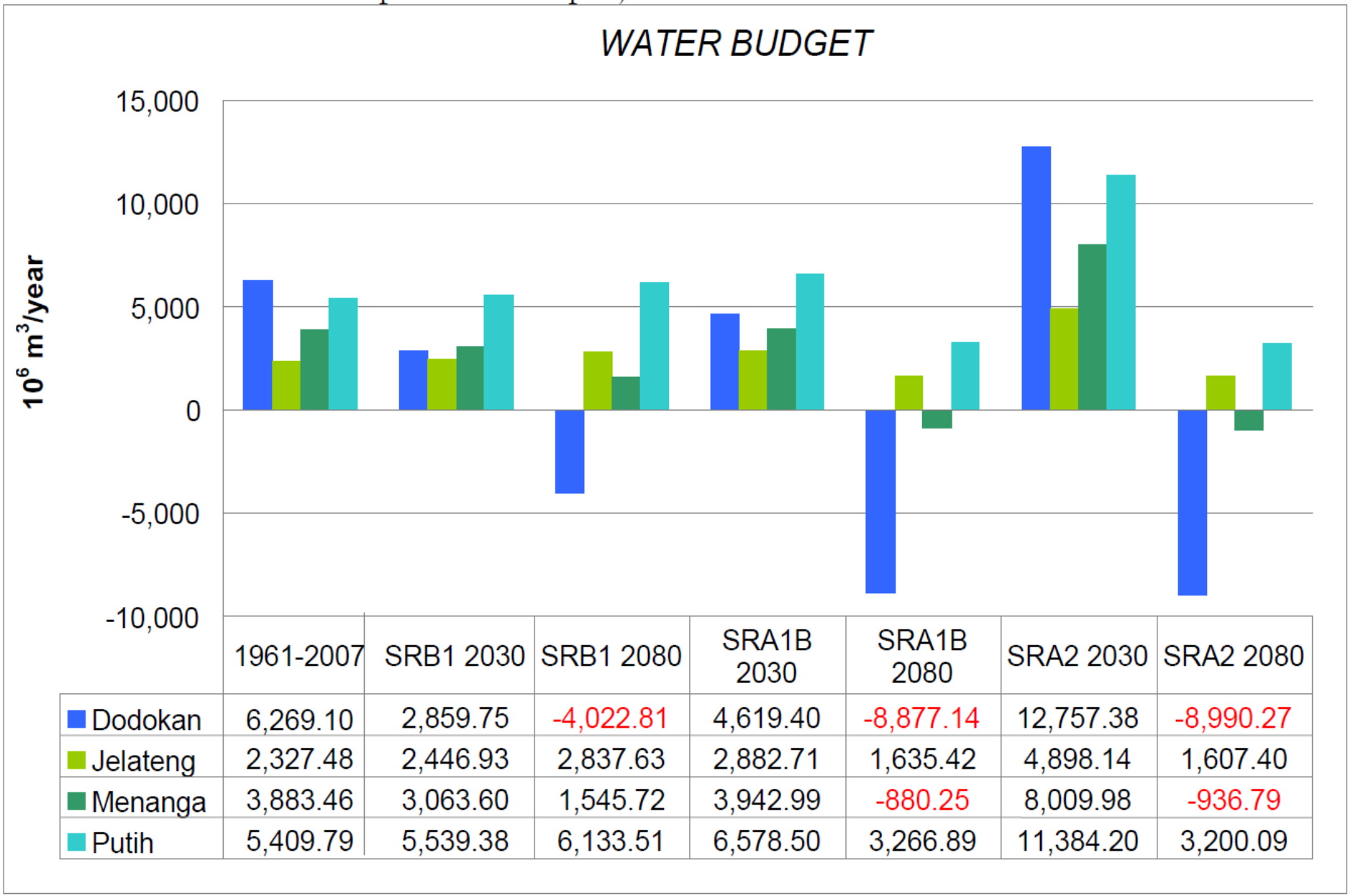


Figure 3.8 Graph of water availability projection (optimum amount of surface water plus groundwater) on Lombok Island for each SSWS baseline (1961-2007) up to 2030 and 2080. Land use assumptions in the projection are similar to the baseline condition.



	1961-2007	SRB1 2030	SRB1 2080	SRA1B 2030	SRA1B 2080	SRA2 2030	SRA2 2080
Dodokan	6,269.10	2,859.75	-4,022.81	4,619.40	-8,877.14	12,757.38	-8,990.27
Jelateng	2,327.48	2,446.93	2,837.63	2,882.71	1,635.42	4,898.14	1,607.40
Menanga	3,883.46	3,063.60	1,545.72	3,942.99	-880.25	8,009.98	-936.79
Putih	5,409.79	5,539.38	6,133.51	6,578.50	3,266.89	11,384.20	3,200.09

Figure 5.2 Diagram of risk notations.

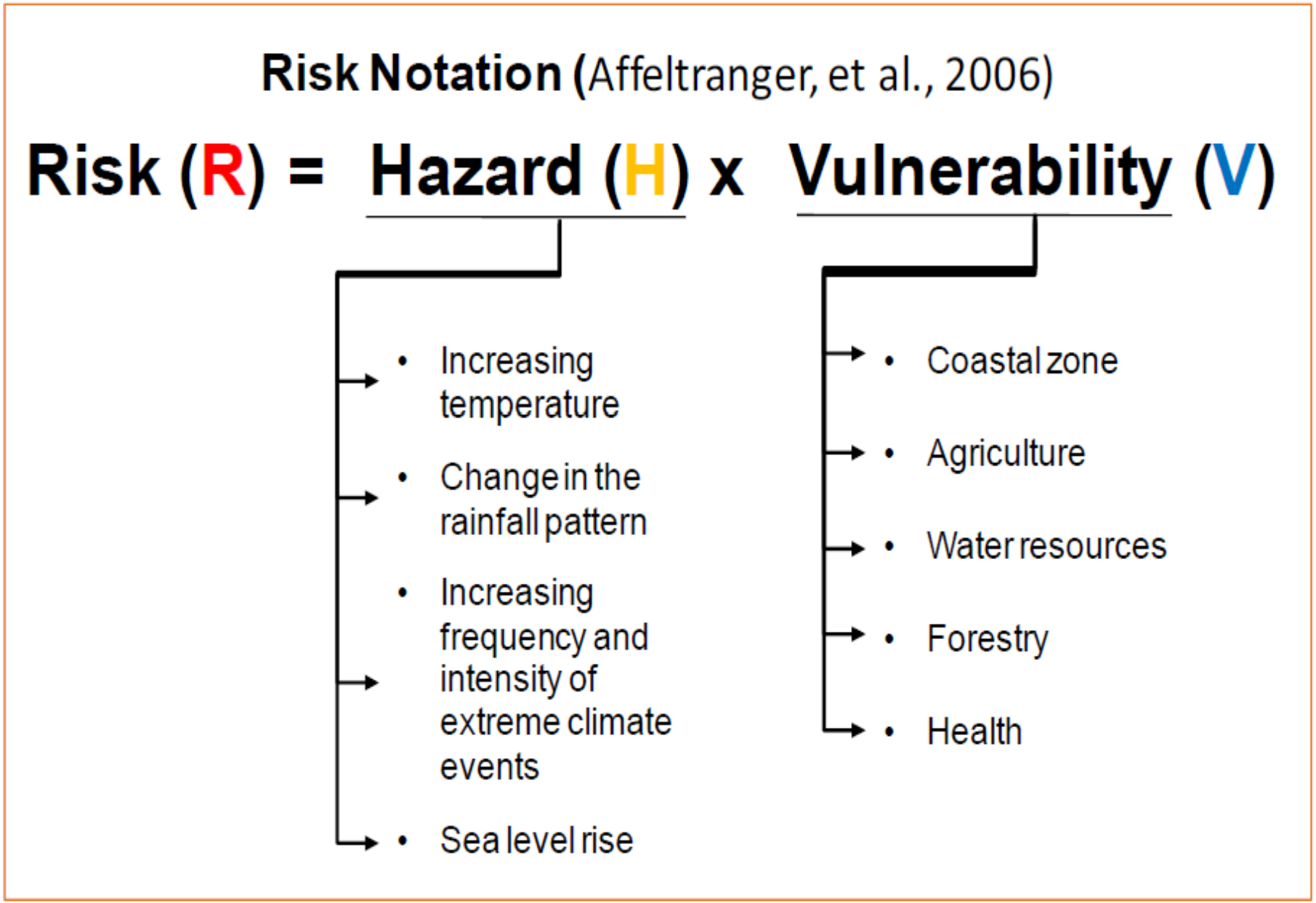


Figure 6.2 Value chain of integrated adaptation on climate change impacts

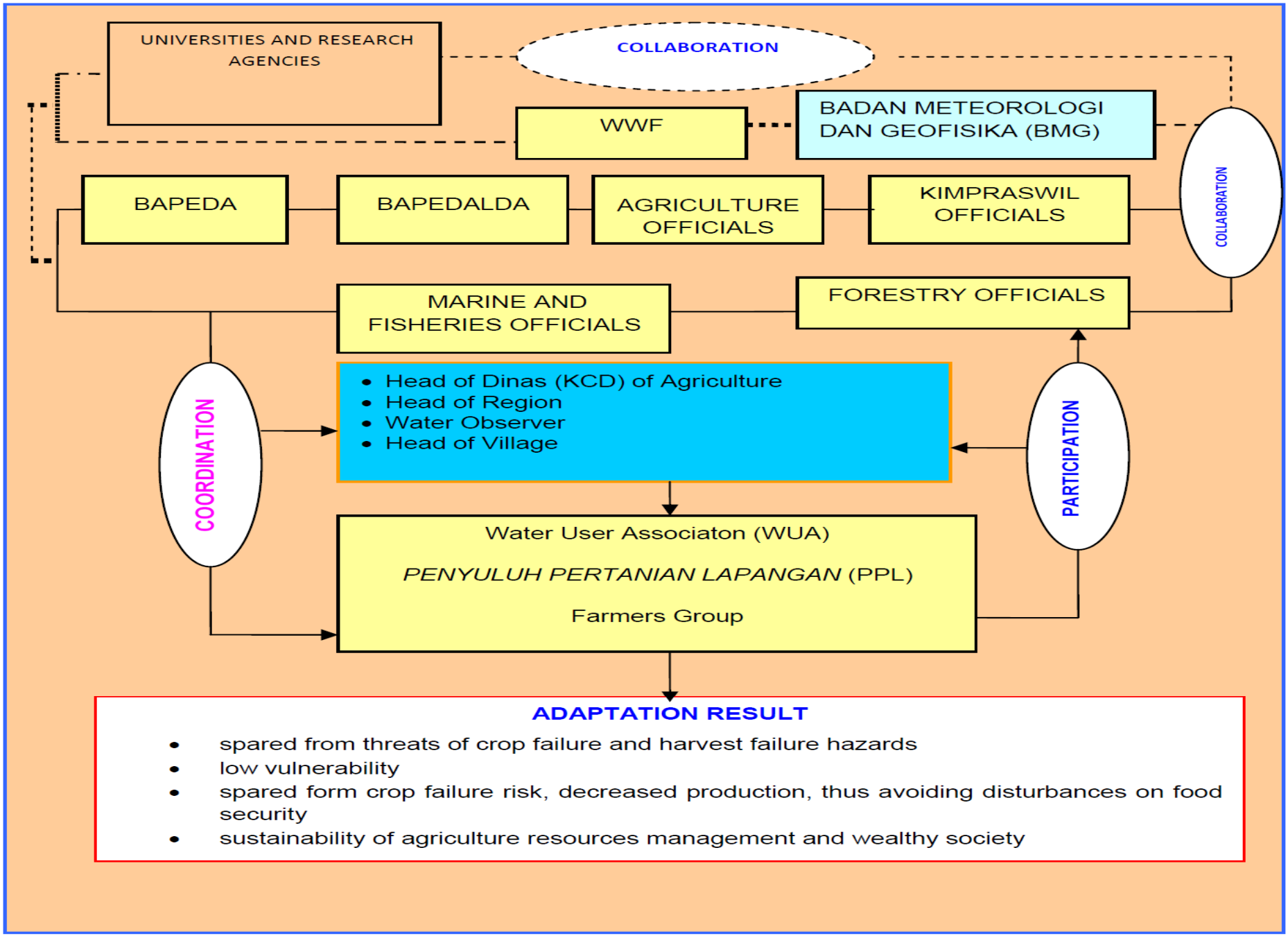
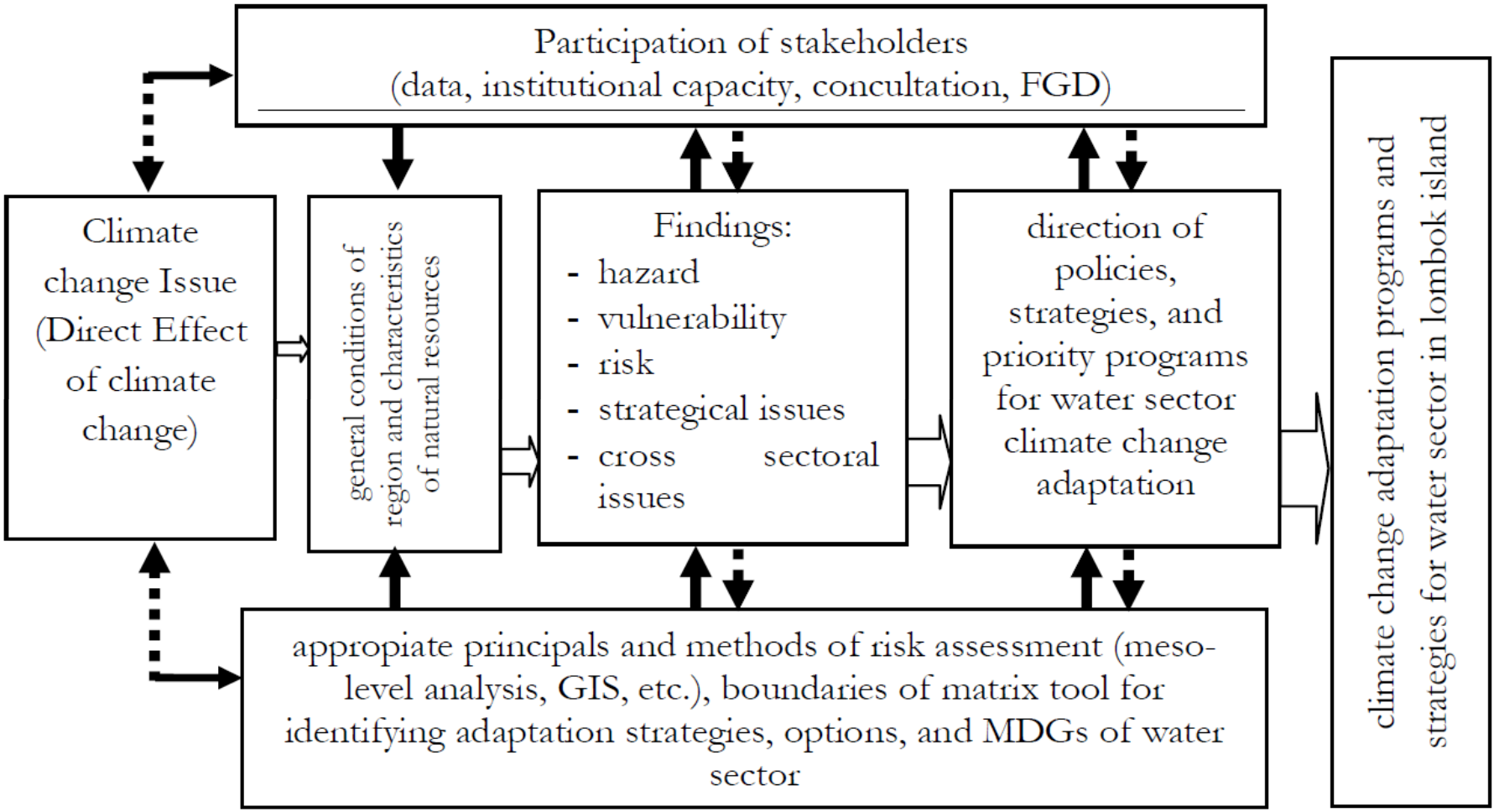


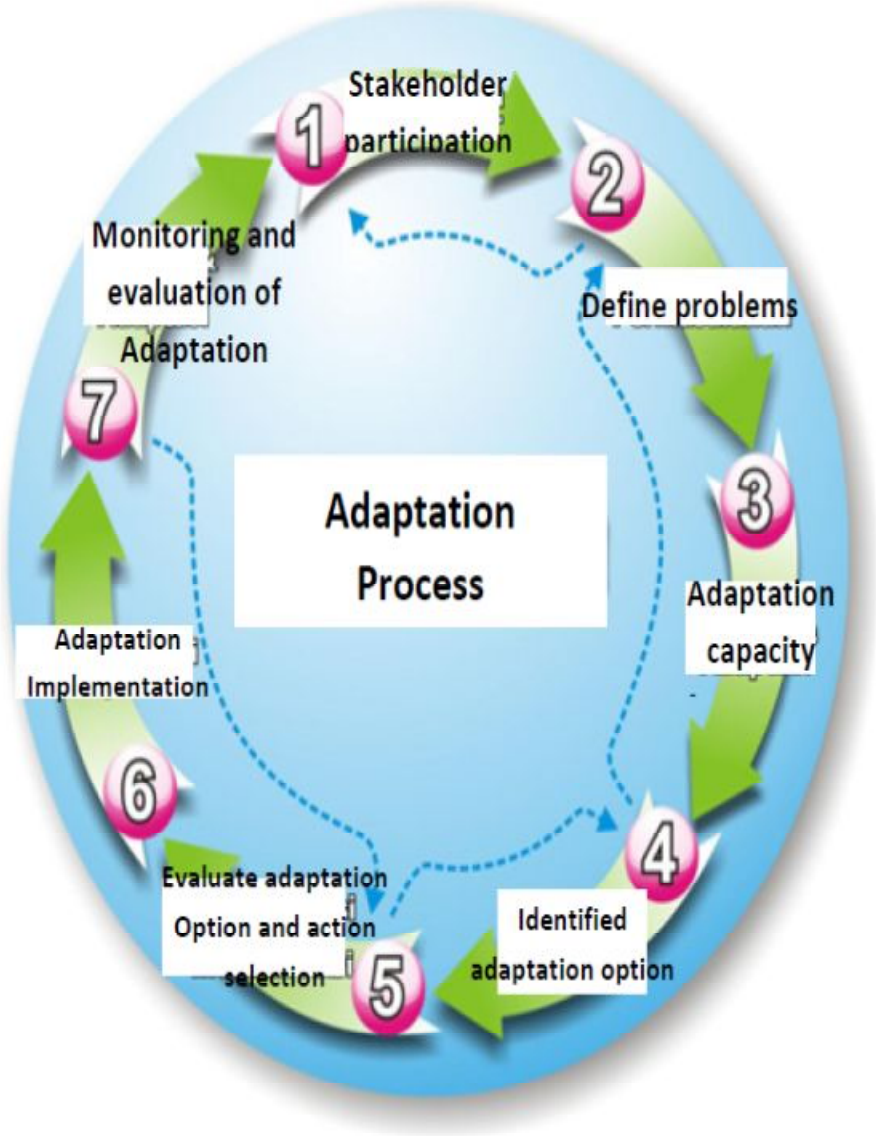
Figure 6.1. Scheme for strategy identification and adaptation program for climate change in water sector in Lombok Island.



Notes: : → inputs/analysis,; ⇢ feedback; ⇨ output/results

FGD: *focus group discussion*

Figure 6.3 The sequence of seven steps in the process of adaptation to climate change (Diposaptono et al, 2009)



7.Discussion Points

- 1.Create New Concept
- 2.Scientific Output
- 3.Policy Recommendation
- 4.Sustainable International Network

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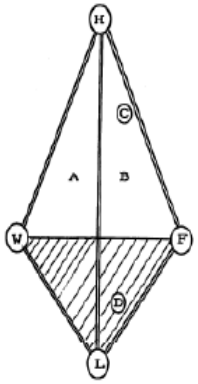

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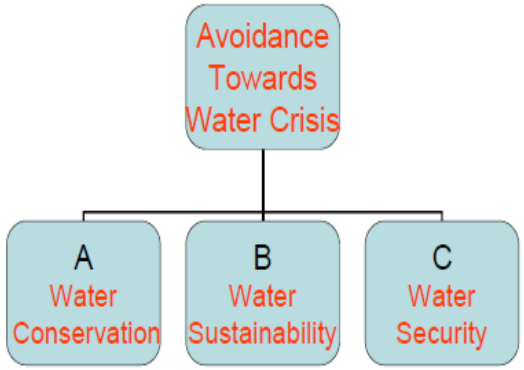
INNOVATION (TECHNOLOGY & INSTITUTION)

SOCIAL & CULTURAL
ECONOMICAL(ECONOMIC & INDUSTRIAL POLICY)
FINANCIAL(BUDGET & FINANCE)
HUMAN CAPABILITY(GWP,TRAINING PROGRAM)

Strategic Adaptation towards Water Crisis



RIHN Workshop Nov,2011,13-15

Wisdom of Land and Water Management Framework on Bali and Strategic Adaptation towards Climate Change

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5.Nakagami's Concern for Bali Project

1. To establish Asian IWRM based on the Wisdom of Land and Water Management

Ⅰ. Research Area

Saba river、Kabupatan Buleleng、Basin Area128.4 km2

Ⅱ. Research Objectives

- To analysis the flexible Adaptation Process concerning about the sustainability in the Subak system , which is confronted the landuse change and damaged irrigation facility caused by flood.
- To examine the landuse regulation and irrigation coordination related to flood control and water resources development in the Saba river.
- To propose Comprehensive IWRM based on the Wisdom of Land and Water Management, which consider the sound livelihood , environmental conservation and climate change.

6.「Wisdom of Land and Water Management(水土の知)」:
7 View Point for Bali Project

–See Through
– What is a Natural Resources Utilization Potential in Bali?
– Use Up
– To Use up water resources ,farm products and water terrace as regional resources
–Make Sure
– To evaluate factors which is examined present dam and agricultural influence caused by climate change
– Set Great Value
– **All components (Agricultural System , Service, Agri Business)in Bali**
– Get a Tryout
– **Maintenance and Management of Water Terrace**
– Foresee
– **The Relationship between Bali and World Bank , ADB and Indonesia Central Government**
– Live Together Happy
– **The Change of Local Inhabitants Consciousness**

Thank you !