

# **Global Infrastructure as Counter Measures for Disaster Caused by Climate Change**

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## **Abstract**

Sustainability usually implied usually that the use of energy and materials in an urban area to be in balance with what the region can supply continuously through natural processes is important concept of sustainability and becomes common sense. But it will be necessary to have some concept of wide sense such as making countermeasure for global problem like climate changes. For instance by global warming, the sea water level will rise. This will be a potential of big disaster of shortage of food, especially in Asia where rice is major crop of food. If level of seawater rise, seawater will penetrate into paddy fields of rice production. Since rice plant cannot be grown in seawater, rice production will be reduced which will cause the big disaster. It is necessary to do some counter measure for this as one of important items in sustainable construction. The movement of rise of seawater will be quite gradual. Therefore, sometime these movements could be overseen. But, it is necessary to be considered as one of the big items in sustainable development especially in Southeast Asia.

## **Keywords**

Climate Change, Rise of Sea Water Level, Paddy Field, Rice Production, Environment,

## **1. Introduction**

Immediate after the Second World War GNP per capita of Japan was same as that of Philippines. After 60years from that, GNP per capita of Japan becomes approximately 50 times as much as that of Philippines. How it become possible. Japan is, in principle, quite poor country since there is no resource except human resources. By industrialization Japan become rich by exporting many products all over the world. And this historical fact established the interpretation that the development of the countries means the increase in GNP per capita by industrialization. Many other countries takes almost same steps therefore there are competition in industrialization and increase in GNP. This situation is quite worse from the global environment viewpoint. It will bring shortage of resources and increase in pollution problem as well. In order to prevent such tendency, It is necessary not only to adjust "Japanese model of development" in consideration of environment but also more active ways to prepare some countermeasure for the disasters caused by the sub-effects of development of the developing countries. One of the examples of this should be the countermeasure for the effect of climate change.

## **2. Common Threat of Climate Change for Human Being**

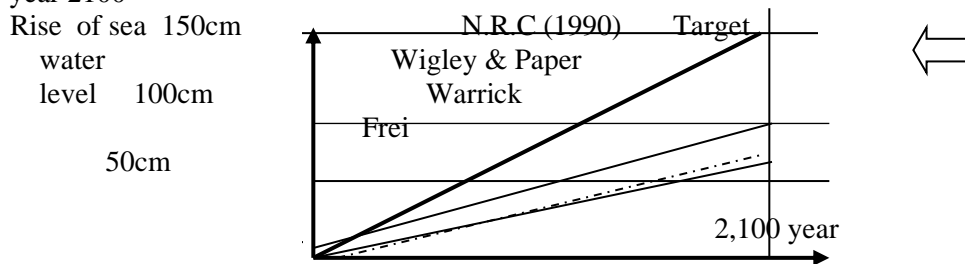
According to the report of IPCC(International Panel of Climate Change:1995) there will be 5 major influences on the life of human being by climate change as follows:

- (1) Spreading out of the epidemic disease of tropical region like malaria.
- (2) There will be more typhoon, cyclone & hurricane. Location of rainy and dry region will be changed.
- (3) Due to the rise of sea water level more erosion of land and penetration of sea-water to river.
- (4) There will be changes in species of forests. Rapid shrinking of forest and expand of deserts will be.
- (5) Fatal shortage of food will cause famine especially in least developed countries.

From view point of sustainable construction (2),(3) and (5) will be field of studies. Especially, civil engineering should be responsible for solving some problems that effect on human being or life of human being by the global climate change.

### 3 Rise of Sea Water Level

The National Research Council (NRC) Panel on Sea-Level Change projects a sea level rise of 50 cm ± 100 cm by the year 2100 (the assumed doubling time for CO<sub>2</sub>). They assume a 3° to 6°C global air temperature rise over the next hundred years based on results from general circulation models at NOAA's Geophysical Fluid Dynamics Laboratory, the National Center for Atmospheric Research, and NASA's Goddard Space Center. The thermal expansion (steric) part of this estimate is based on the work of Frei et al. (1988) who used two models for carrying heat down into and up out of the subsurface layers of the ocean, a pure diffusion model and an upwelling-diffusion model. They project a 10 to 50 cm rise over the next century. For the contribution to sea level rise from ice wastage/melting the NRC panel used the results of the NRC Committee of Glaciology (NRC, 1985), whose "most likely" scenario was 55 cm ± 21 cm by the year 2100



**Fig.1 Estimated Amount of Rise of Sea water Level**

Warrick and Oerlemans (1990) (in the IPCC report on scientific assessment of climate change) project, for a "business as usual" scenario, a sea level rise of 21 to 71 cm by the year 2070, with a best estimate of 44 cm (66 cm for the year 2100). The thermal expansion part of this estimate is based on the upwelling-diffusion model of Wigley and Raper (1987), using projected global air temperature rises of 1.5°, 2.5°, and 4.5°C, with the middle value considered a best estimate. They used the glacial contribution calculated by Raper et al. (1990) using a simple global glacial melt model, and they assumed no contribution from the Greenland or Antarctica ice sheets. Both these review papers also list projections by various researchers with "best estimates" ranging from 20 to 100 cm. There have been many estimation reports on the amount of rise of sea water level as shown in Fig.1. Since estimation of seawater level rise is not decisively fixed, it is better here to consider as some condition to consider the amount of the sea water rise by the end of this century might be some around 150cm as a target

### 4. Effect of Sea Level Rise on Rice Production

#### 4.1 Rice as Major Crop in Southeast Asia

Major food crops in the world are wheat, rice and others. And distribution of the regions of production of these crops is depending on the geological and climate characteristics of lands. The production of rice is done mainly in Asian countries as shown in table 1 below.

**Table 1. Major Country of Rice Production**

	Country Name	Production in 1,000tons	Percentage			Country Name	Production in 1,000tons	Percentage	
			export	to total				export	to total
1	China	192,971	2.0	34.3	5	Bangladeshi	28,293	-4.0*	5.0
2	India	122,244	3.9	21.7	6	Thailand	23,240	27.3	4.1
3	Indonesia	48,472	-3.9*	8.6	7	Myanmar	16,651	----	3.0
4	Vietnam	29,142	13.0	5.2	8	Japan	11,200	3.2	2.0

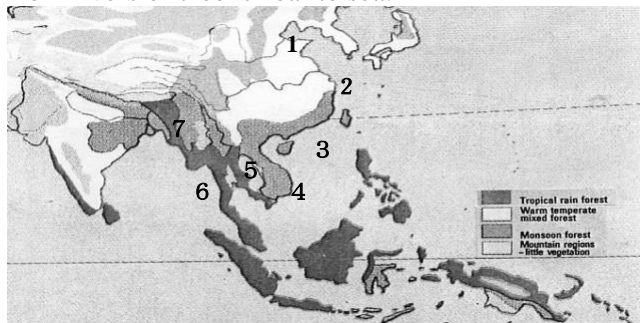
Note: \* show import

Total 83.9

Therefore, the influence by rise of sea level on production of rice in Southeast Asia could be important to discuss the supply condition of rice in future.

#### 4.2 Effect of Rise of Seawater Level on Rice Production

Effects of rise of seawater level will be remarkably big on the agriculture. Especially effect on rice production is considered big, because rice is produced in the paddy field where water should be supplied from rivers or creeks near to sea.



Names of rivers

1. Yellow River
2. Chang Jiang (Yangtze)
3. Hong
4. Mekong
5. Menam (Chao Phraya)
6. Ayeyarwady
7. Ganges

**Fig.3 Chief Vegetation and Major Rivers with Large Deltas**

If sea water level will be rise, seawater will go to rivers or creeks to paddy field. Since rice cannot grow in seawater, production of rice will go down remarkably. Fig.3 shows the general vegetation in Southeast Asia and major rivers of large deltas where paddy field of rice is concentrated.

In the case of the river Chang Jiang (Yangtze) there is huge dam under construction and considerable influence on production of rice in the region might be expected after completion of this dam. Therefore, it can be better to start this kind of research after operation of dam.

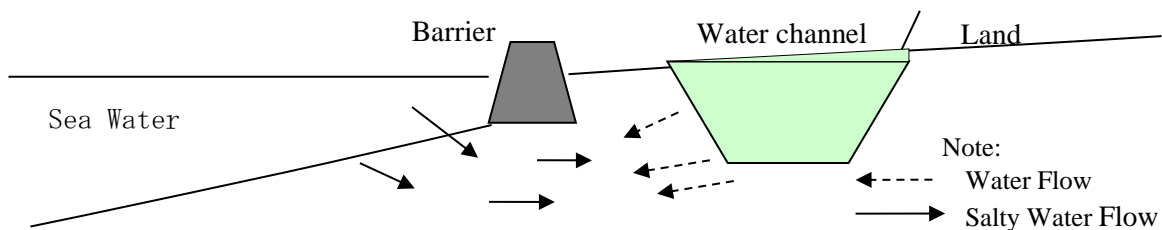
### 5. Planning and Execution of Construction

#### 5.1 Search of General Systems of Countermeasure

Actual way to prepare for rise of seawater level will be done by mainly to different systems. First is to avoid seawater to penetrate into river by some kind of wears and water gates. Another should be to make channel of water line along with shorelines to prevent penetration of seawater to paddy field near to coast with some protection of corrosion. There should be something unknown for countermeasure of rise of sea water level. In many regions some lands are under subject of flood. Floods may occur in rainy season and bring some fertile soil that will realize good harvest of rice. In these regions elevated floor of the house is common. In this region if sea water level will raise seawater will easily come to paddy field. It is difficult to conclude but some systems combination of 1 and 2 may be applicable. International action and cooperation of the countries will be indispensable to prepare any countermeasure for these kinds of problem.

## 5.2 Actual Systems of Counter Measure

For protecting seepage of salty water, a model of the system is as shown in figure 4. One of the examples of typical and quite large scale can be seen in Nederland where considerable portion of land is under the sea water level.



**Figure 4. Barrier and Water Channel for Prevention Seepage of Salty Water**

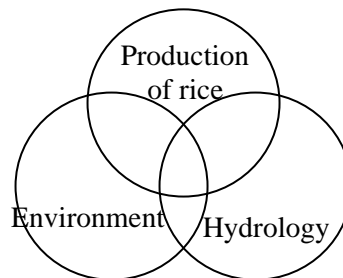
## 6. Problems to Be Solved

### 6.1 Inaccuracy in Estimation for Prediction

In the case of environmental problem, it is not possible to determine with certainty what result some particular policy of countermeasure will be, because scientific predictions by estimating are quite imprecise.

### 6.2 Environment Changes Caused by Counter Measure

Counter measures for climate change will cause another problem of changing environment such problems as in the Moses project in Venice and Osterschelde and Westerschelde project located river mouth of Rhine near to Hoek Van Holland of Netherlands. These huge projects are considered to cause another big problem of change of environments of the regions that should be solved totally. Therefore, to make any system some total assessment should be indispensable.



### **Fig.5 Balance of Three Components**

From this point of view any systems for protection of sea water seepage should be assessed in the balance of these three components; agriculture (production of rice) environment and Hydrology as shown in figure 5. The relation between these three components make the problem too complicated to be solved and it takes long time to determine the due solution system. Also, this complication causes many public objection to construct actual facilities of system.

### **6.3 Risk Treatment by Policy**

Treatment of this type of risks will have two dimensions as follows;

1. Identifying and quantifying risks. 2. Determining the acceptable extend of risk. In these cases benefit-cost analysis may be applied. But, it could be more practical to set up several scenarios to study. It is not necessary to make a dominant policy. And it may be impossible to do so. The best and only way is to make several alternative policies to treat this kind of risk flexibly in accordance with the process. Also, the risk is not even to the countries concerned, therefore, it is necessary to establish consensus to the risk among countries.

### **7. Conclusion**

For sustainable development usually many studies have been mainly done for environment problems and saving resources. However, one of the subjects to be studied before it will become too late should be study on countermeasures for disaster that might be caused by climate changes, especially global warming.

The biggest possible disaster will be the disaster caused by rise of sea water level. Because rice plant cannot grow in seawater, there will be fatal poor harvest of rice to bring famine especially in Southeast Asia. This disaster should be avoided by taking some countermeasure depending on the prediction by geophysics and meteorology. The prediction of environmental problems is not clear. Therefore, more flexible approaches will be necessary.

This problem should be preoccupation for people of Asia. People in rather developed countries in Asia study this and prepare some countermeasures together with people in developing countries. Also, this will be studied and executed by the people of the world because the sustainable development of Asia, economically, politically, and culturally, is one of the important issues that will be taking place in the world of Today.

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