Technology Dynamics and Transition Management in China

Water Problems in Indonesia: the Solo Valley case

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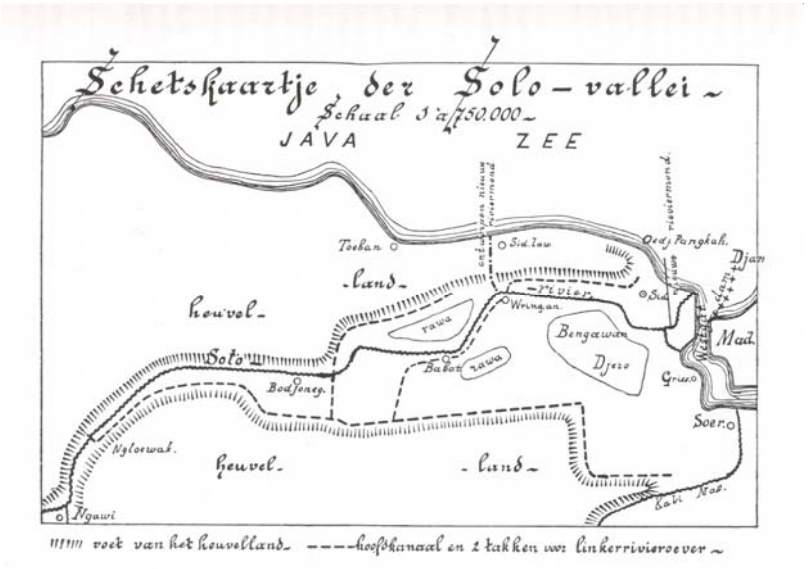

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The Hoover Dam

Colorado River, US

Realised under bad work conditions

In the spirit of the time: large governmental projects

Influence of Russian concepts: state intervention

technocratic hierarchical project, planning, ruthless rule (Stalin's approach, Roosevelt's New Deal)

Made the desert bloom and more

Increased salinity levels in Colorado River water

Negative consequences of big dams in general include: disruption of ecosystems, decline of fish stocks, forced resettlements and disease

www.usbr.gov

Water Problems in Indonesia

Flooding 2007

http://upload.wikimedia.org/wikipedia/commons/thumb/b/b8/Flood_2007_-_Taxi_drowned.jpg/300px-Flood_2007_-_Taxi_drowned.jpg

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Water Problems in Indonesia

Flooding

Historical background information

Solo Valley problems

Illuminate the concepts of the model

Next lecture: specify the model and apply it to present-day Solo Valley problems

Water Problems in Indonesia

The Solo Valley

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The Solo Valley

Solo Valley: poor region, flood-stricken during west monsoon, droughts during east monsoon

Between 1 and 2 million people, living off rice-farming and fishing.

These activities are supported by three big reservoirs and many small reservoirs in the valley; one upstream reservoir

The Solo Valley

Background: Dutch irrigation and flood protection engineering in Indonesia

Indonesia: 220 million inhabitants, biggest Muslim country, 13.000 islands.

Staple: rice. Half of the population engaged in rice-farming. Rice self-sufficiency in the 1990s.

Most productive rice-farming uses irrigation. Irrigated rice-farming at least 2.000 years old.

Indonesia has been a Dutch colony: the Netherlands East Indies 1600-1800 VOC; 1800-1950: colonial state.

The Solo Valley

Background: Dutch civil engineering in Indonesia 1942/9:

1.5 million hectares agricultural land with *technological irrigation and drainage*; in Java and Madura 1.3 million hectares of the 3.3 million hectares of paddy fields (2/5 of the Netherlands)

a *road* network with 12,000 km of asphalted surface, 41,000 km of metalled road area and 16,000 km of unimproved surfaces (1.7 times the earth's circumference)

a 5,500 km long network of *railway lines* in Java and at least 2,000 km of tracks in Sumatra (the Netherlands: 3,300 km)

International *harbours* in Medan, Batavia (presently Jakarta) and Surabaya

140 public, particularly urban *drinking water facilities*, largely on Java

Many modern *bridges* carrying roads and railroads

The Solo Valley

Irrigation and flood control engineering and state formation

..... – 2000: small-scale Javanese irrigation

Early colonial state

1800 – 1870: separate works to support exploitation

Intermediate colonial state

1870 – 1920: complete systems of irrigation and water control for sugar and rice

Modern colonial state

1920 – 1950: + refined technical parts based on laboratory research

Indonesian republic

1950 – .....: + interbasin transfer, Integrated River Basin Management, Room for the Water, esp. for rice

Irrigation works in Java,

van Blommestein

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Irrigation works in Java

Project Elements

Work in progress

1929

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Irrigation works in Java

Project Elements

Dam in the Tjisadane River

What you see, from the plane when you fly into Jakarta

Constructed in 1934, photo 1995

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Irrigation works in Java

Project Elements

Dam in the Tjisdane River

The same dam,

ground level

Constructed in 1934, photo 1995

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Irrigation works in Java

Project Elements

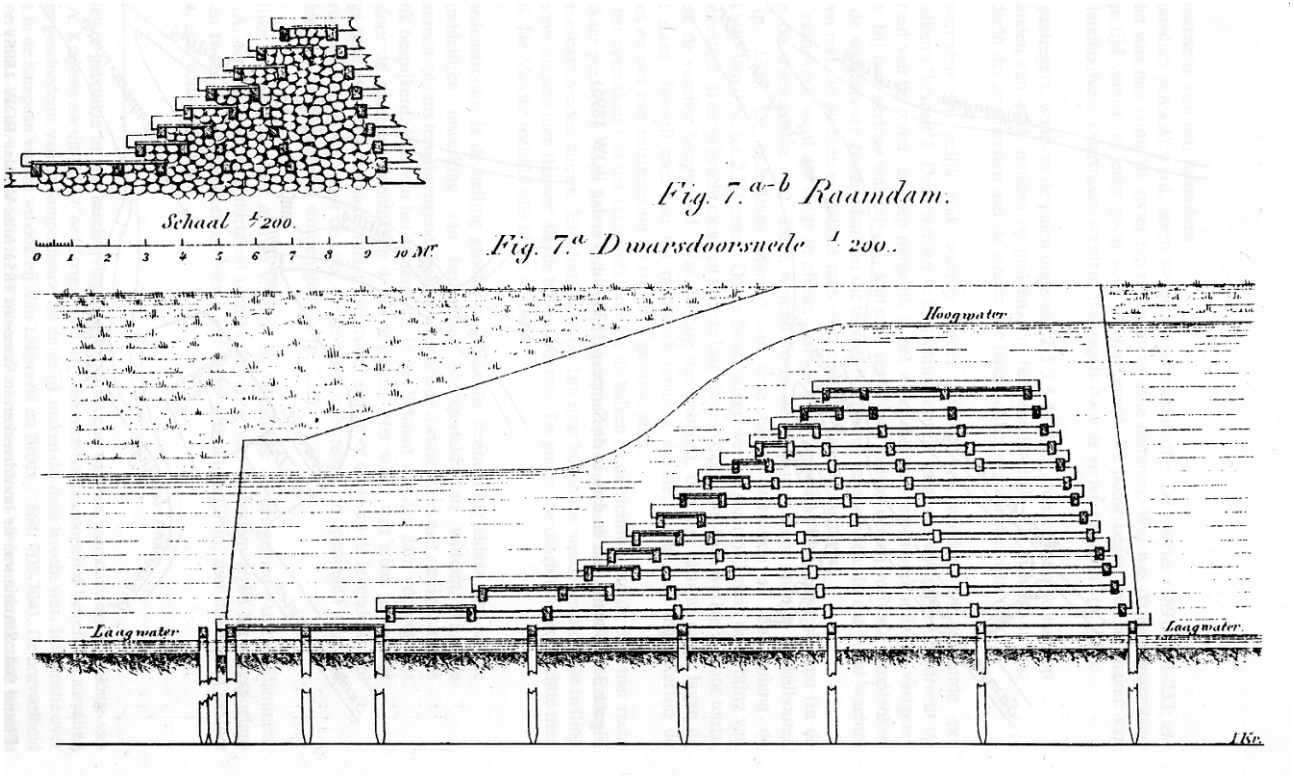
Dam in the Tjitaroem River

Constructed in 1925
(photo 1938)

Irrigation works in Java

Project Elements

Sketches of the first dam in the Sampean River



Constructed in 1832

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Irrigation works in Java

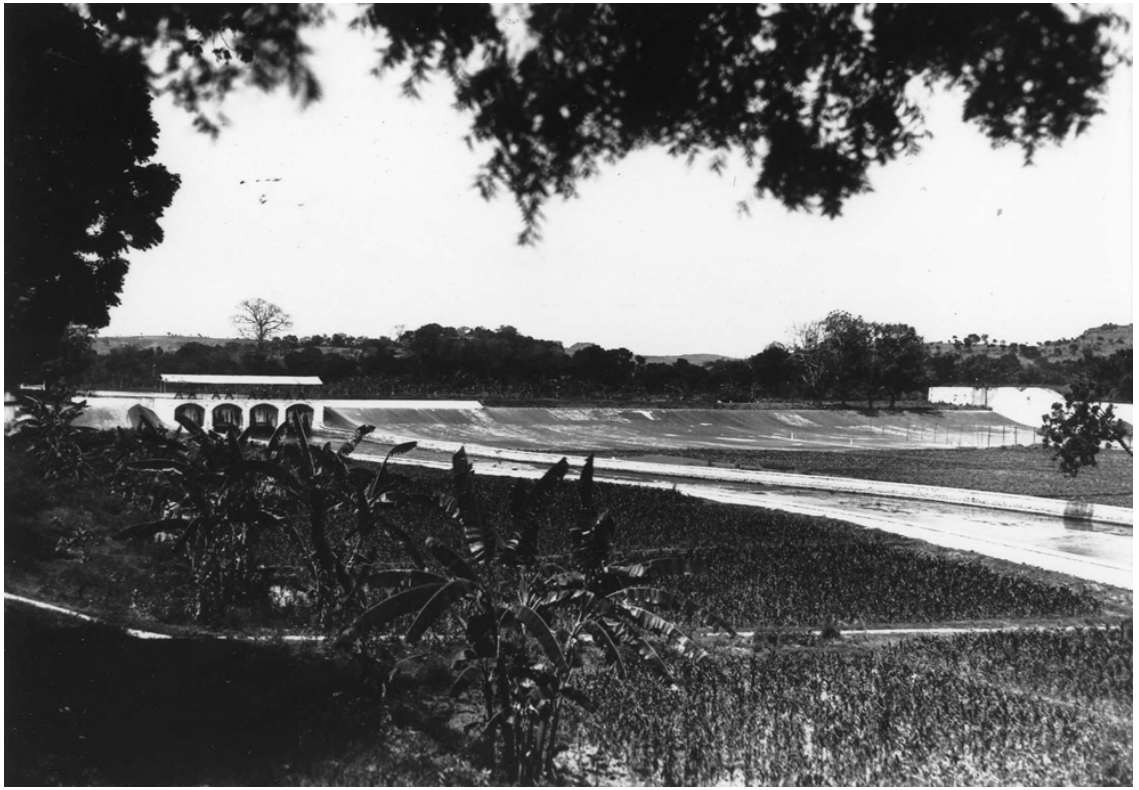
Project Elements

The Sampean River- dam with drainage sluice:

how initial sketches developed

Construction in 1876 and 1900

(photo 1932)



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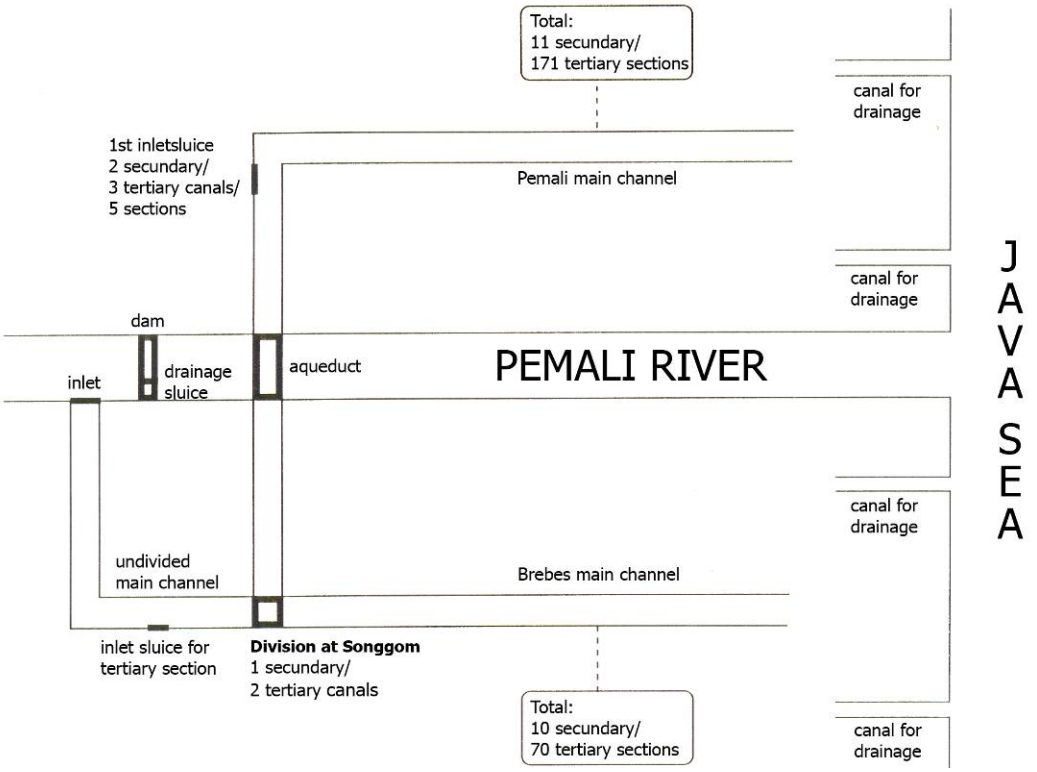
Irrigation works in Java

Project Elements

Pemali irrigation system

Devising a larger system to connecting systems

Constructed in 1896



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Irrigation works in Java

Project Elements

After constructing main parts of the structure (dams, irrigation systems) reservoirs were developed and created

1931

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Irrigation works in Java

Project Elements

Looking down from the reservoir in the previous slide onto the head canal leading away from it

1931

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Irrigation works in Java

Project aims

Planting out of Rice Seedlings

1900

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Irrigation works in Java

Project aims

Rice harvest

1920

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Focus: Solo River

The Solo Valley

Solo Valley: poor region, flood-stricken during west monsoon, droughts during east monsoon

1900 720.000 people, mostly farmers; now between 1 and 2 million.

Fishing was another means of sustaining life; there were many fishponds filled with west monsoon water as well as many irrigation reservoirs.

The Solo Valley

Irrigation Plan

1893-1898 Irrigation Plan

- 156,000 hectares
- weir to force up the waters by 8 m
- main canal of 165 km
- network of smaller canals of 900 km
- redirecting of the Solo, making it flow into the Java Sea, 35 km to the west
- canal for a shipping and drinking water supplies

The Solo Valley

Projected Place of the Solo Weir

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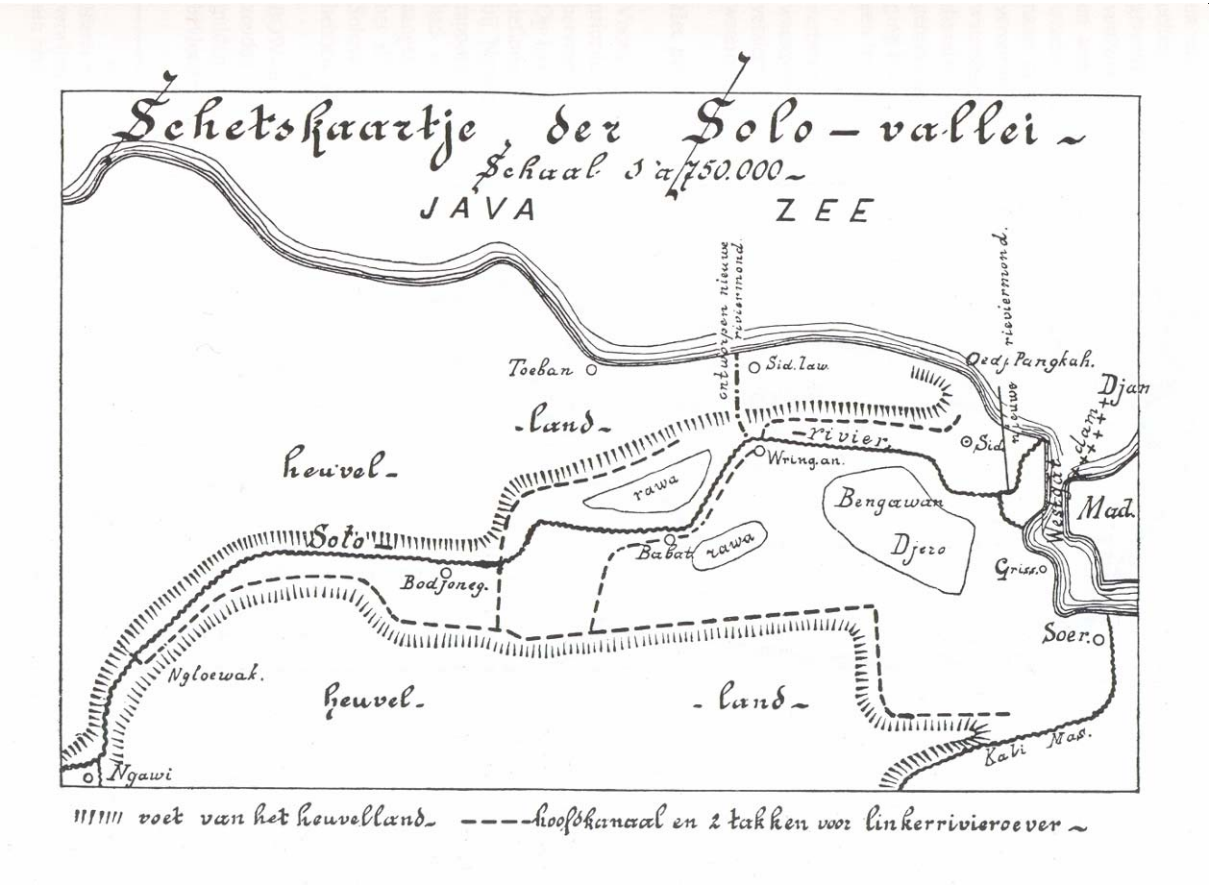
The Solo Valley

Solo Valley Works



The Solo Valley

Consequences

Plan cancelled for financial, technical and agricultural reasons

Irrigation engineering in crisis:

Will the government continue financing irrigation works?

Will it maintain Public Works Department?

However, no dramatic consequences, because *actor involvement assured continuity* of irrigation engineering

The Solo Valley

System Analysis

Development mechanisms

- *Momentum*: a variety of actors gets involved in system building and makes systems growth quasi-autonomous; socio-technical irrigation and drainage system building had acquired momentum by 1900 in Java

- *Reverse salient*

The Solo Valley

Reverse Salient

A reverse salient is a part of the system that is *falling behind* in its development

The systems *innovative capabilities* are directed towards occurring reverse salients

To attack them successfully, reverse salients have to be reformulated as *critical problems*

Solo Valley formed a reverse salient in the irrigation engineering activities: project considered too expensive, too risky, too complicated

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Critical Problems and their Solutions

Too expensive

→ *profitability* ➔ distinction profitable-unprofitable with extra $ for unprofitable works; step-wise/piecemeal engineering; agricultural research into the significance of silt; reservoirs (→ multi-purpose reservoirs, inter-basin transfer)

Too complicated

→ *how to coordinate agricultural activities* ➔ irrigation management, culture plans (→ water authorities, water users associations)

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Critical Problems and their Solutions

Too risky

→ *too big* ➔ compartments; laboratory research; indigenous reservoir technologies; big reservoirs (→ multi-purpose reservoirs)

N.B. Turning reverse salients into critical problems involves expert interpretations and actor perceptions

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Regime Shift

Technical Irrigation Regime transformed into the *Technical Agricultural Irrigation Regime* in the 1870-1920 period in Indonesia

Main difference: **agricultural considerations**, brought in by a new (expert) actor: agricultural engineers

Solo Valley works contributed to this regime shift and was also stopped because of this regime shift

The Solo Valley

Alternative: Solo Valley Reservoir Plan

Combination of – indigenous inspired – small and big reservoirs; extra money because works not profitable; new forms of cooperation and management

However, *dramatic situation continued*; the original Solo Valley Plan remained in discussion till the end of the colonial period and up to this day!

The Solo Valley

Post-colonial water engineering in the Solo river area 1

1974 Japanese plan:

- 30 reservoirs in the river basin, including four very big ones; irrigation for rice and maize!

Problems:

- too expensive, also because of ‘transmigrasi’ costs
- transmigrasi socially unacceptable for foreign financiers → reservoirs taboo (no -global- social support)
- two provinces involved, unequal costs and benefits → river basin management

Result: only one big reservoirs built

The Solo Valley

Post-colonial water engineering in the Solo river area 2

1986 Canadian plan (looked like colonial Dutch plan):

new big reservoir, drainage canal to Java Sea, turning a swamp into a reservoir to temporally store water (‘room for the water’)

Problem: new big reservoir

Result: only drainage canal has been built

The Solo Valley

Present Day Solo Engineering

On top of the many large and small measures until now, a new master plan is being prepared, including a series rubber dams and the Canadian water store reservoir

The Solo Valley

How to deal with the Solo Valley problem in terms of this course?

Actors

The auspicious Lords of the Waters! Floods create fertility

Local people asked the government (in the 1990s) to continue Dutch project! Droughts?

Political system does not facilitate participation, though world opinions have great influence

Transmigration. Good or bad?

The Solo Valley

How to deal with the Solo Valley problem in terms of this course?

Socio-technical water system for irrigation, transportation, drinking water, industry, electrification, tourism / locally works from various plans ➔ push for works that link up with existing infrastructure

Technological regime: 'Totalitarian hydraulic management' (control every drop), Integrated River Basin Management (IRBM: multi-purpose reservoirs, basin wide approach, regional development) → Room for the Water ➔ old or new?

The Solo Valley

Plans

1974 Japanese plan: 30 reservoirs in the river basin, including four very big ones, latter for both irrigation and electricity; irrigation for rice and maize!

1986 Canadian plan (looked like colonial Dutch plan): new big (multi-purpose) reservoir, drainage canal to the Java Sea, turning a swamp into a reservoir to temporally store water ('room for the water'), rehabilitations

The Solo Valley

Analysis and Evaluation of the two Solo Plans

	Japanese Plan 1974	Canadian Plan 1986
Actors Incremental or radical	Large variety of water users System growth through increasing number of (multi-purpose) reservoirs, based on existing totalitarian & IRBM water control regime	Farmers and citizens in the valley System innovating marsh-reservoir, reflects new Room for the Water regime
Safety	-Risk of large dams	-Would not solve all the problems
Sustain-ability	+Cropping pattern based on natural possibilities (maize) -Highly controlled environment -Large use of scarce water resources (salty soils, desert formation)	+ Natural solution for storing water through upgrading a swamp

The Solo Valley

Analysis and Evaluation of the two Solo Plans

	Japanese Plan 1974	Canadian Plan 1986
Ethics	+High development potential (electricity)	-Low development potential
Social actors	- Transmigration +Employment possibilities -Artificial fertilizers should be bought	-Local population could suffer from continued flooding +Silt fertilizes soils
Advice	5- / 3+ / Easy to implement, good for development, short term solution N.B. Costs are only secondarily considered	3- / 2+ / fits in long-term, nature-based development Preferred Solution

Group Assignment

Prepare a presentation of your problem analysis and an analysis of the two solution possibilities you propose.