INTEGRATED WATER MANAGEMENT SYSTEM FOR USHIZU AREA

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1. Introduction: During the last decades a system for integrated water management was developed in the Netherlands, called PAWN (Policy Analysis for the National Water Management of the Netherlands). It is an analysis of the impact of different policies to manage and control the available water. Policy analysis was found to be a powerful tool for integrated water management. This tool was applied to establish an integrated water management system for Ushizu area.

2. Theoretical background of integrated water management: Since ancient times people always wanted to control water, mainly to protect their lives, houses and land. An old Japanese saying is: 'One who can manage water can manage the entire nation'. Nowadays man is able to control water to prevent flooding to a certain extend. But in modern society new problems arose, for example land subsidence, surface and ground water pollution, apart from the still existing problems such as inundation. Many users use the same water. Different users and authorities control this water. Integrated water management combines all the factors that influence and are influenced by the water system, to find one encompassing water management system for society. It includes management of the quantity and quality of the surface and ground water of an area. Policy analysis is a powerful tool to establish such an integrated water management system.

Authorities have to make decisions on policies for the future. These decision makers often have limited insight in the impact of a policy. Policy analysis provides better insight in the impacts of policies. It does not include the (political or bureaucratic) decision making itself. Policy analysis is a part of the policy cycle (see figure 1.). It involves objective analysis of the existing system with its problems. Then an assessment of different policy options is made by usage of computer models and expert predictions for each defined scenario. The results are made public and presented to the decision makers. It can be presented by scorecards (see figure 2.), cost-benefit analysis, multi criteria methods etc. The costs and benefits are presented as much as possible in their own units (e.g. crop production in ton/year or concentration of BOD) for each policy option. The presentation must be simple and easy to understand. The decision makers have to judge on the importance of the different units and select the preferred policy option. Regularly the implemented policies should be evaluated and adjusted if necessary. It has to be borne in mind that policy analysis is merely a prediction of the future and can therefore never be exact (because of the many processes involved and the uncertainty of nature).

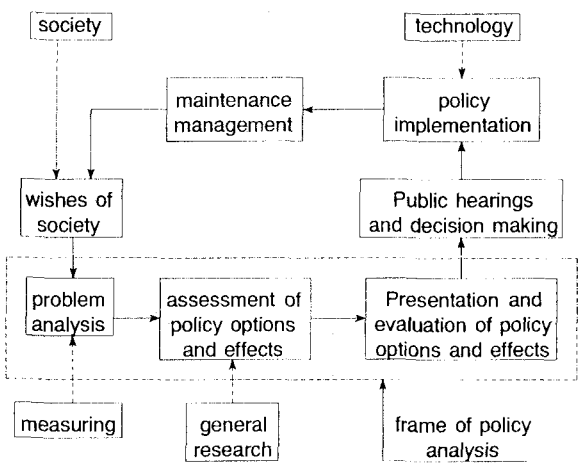

Figure 1. Policy cycle for water management.

The important terms for water management are:
- (User) functions: Functions of water bodies (e.g. agriculture, shipping, recreation, industry, power supply, households and environment).
- Tactic: Individual action that can be taken to change the existing system.
- Strategy: Combines tactics of the same kind.
- Policy: Consists of combinations of different strategies.

- Scenarios: Scenarios are related to variables influencing the behaviour of the system but which do not belong to this system (and thus cannot be changed by the water manager).
- Criteria: Units in which the impacts of policies can be expressed.
- Impacts: The effects a policy has on the water system. The impacts of each policy can be presented in a scorecard or by other means.

3. Integrated water management system for Ushizu area: To give an impression of how to establish an integrated water management system, policy analysis has been applied to Ushizu area. This is an example and by no means complete.

- **Problem analysis:** Ushizu is a small rural area of 97 ha. in Saga prefecture, Japan. About 2500 people live in this area. Two main problems regarding water quantity and quality can be distinguished. During the summers heavy rainfall often causes inundation of the area. This causes damage to crops, assets and disturbs the daily life of the population. The second problem is a bad water quality during the autumn, winter and spring seasons, when there is little rainfall. In many canals there is stagnant water or little water flow. Waste water (except for night soil) is discharged directly into those canals. High concentrations of BOD and low concentrations of DO can be measured in the area.
The desired situation is: More protection against inundation and a better water quality, so that people in Ushizu may be able to swim in the canals again (like only 30 years ago).
- **User functions:** Functions of the water in the area are irrigation for agriculture, drainage of rain and domestic waste water, recreation and environment.
- **Tactics:** The following Tactics may be promising to achieve the desired situation. They are divided into three policies and the 0-policy (no changes in the current policy):
1) Anti-inundation policy: Construction of pumping stations to Ushizu river; Improvement of the canal system;
2) Anti-pollution policy: Construction of a waste water treatment plant and sewerage system;
3) Mixed policy: Improvement of the canal system; Increase inlet of water during dry periods; Different weir operation in the area.

Policy	-0-	-1-	-2-	-3-
Benefits* [1]:	0	100	0	45
Costs*:	0	190	154	20
B/C ratio(-):	-	0.53	0	2.3
Inundation(yr):	1	5	1	2
Recreation:	no	no	yes	yes
Conc. BOD(ppm)**:	26	17	2	4
Conc. SS(ppm)**:	29	24	5	8
Political feasib.:	good	normal	bad	normal

*in 10^6 ¥/year.; **Worst value.
[1]Reduced damage from inundation control is included.

Figure 2. Sample scorecard.

- **Scenarios:** The following scenarios are defined for Ushizu area:
Increase/decrease in the population of the area; Changes in the load of the discharge from the households; Rainfall with different return periods.
- **Criteria:** Some of the criteria to assess the impacts of the alternatives are:
Socio economic: Total annual benefits (¥/year); Total annual costs (¥/year); B/C ratio (-).
User related: Damage to paddy crop and assets due to inundation (¥/year); Recreation; Environmental: Water quality parameters BOD, SS, TN, TP (ppm).
Planning and implementation: Political and legal feasibility of the alternatives;
- **Assessment:** To assess the different impacts of the policies computer models and expert predictions are used (e.g. for the assessment of the concentrations of BOD an unsteady state computer model was used).
- **Presentation:** Finally results are presented to the decision maker. A sample scorecard is shown in figure 2., for one scenario (no changes of external variables in the present situation). For each scenario a scorecard can be made. It is easy for the decision makers to understand the impacts of the different policies. The decision makers then have to decide how important the impacts are and select the preferred policy.

4. REFERENCES:

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- Ministerie van Verkeer en Waterstaat, Derde Nota waterhuishouding, notanummer 90.061. (Ministry of Transport and Public Works, third PAWN document, note number 90.061.)