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GROUP JUDGMENTS IN FLOOD RISK MANAGEMENT: SENSITIVITY ANALYSIS AND THE AHP

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Abstract:

Flood management is an important issue in Japan as Japanese rivers are steep in gradient and short in length, and some 120 million people populate the river basin densely. The AHP is shown to be a valuable technology for aggregating group judgments. Sensitivity measures are developed to determine the robustness of the consistency ratio and the principal right eigenvector to perturbation in the group judgments of the pairwise comparison matrix. This paper investigates how uncertainty in each of the input variables affects the derived output variables.

MCDA for flood management is one of the fastest growing areas in operations research, borrowing heavily from fields such as hydrology, geology, psychology and computer science. Most flood management problems in Japan are participatory processes which inherently involve input from a variety of decision makers, whose judgments must be aggregated. In the context of AHP, the aggregation of group judgments is discussed. Next, sensitivity metrics are proposed to quantify the notion of robustness to uncertainty. It is shown that the derived consistency ratio and principal eigenvector are insensitive to small perturbation of the consistent pairwise comparison matrix.

An important problem in decision analysis involves the combination or aggregation of problem-solving knowledge and judgments. In the context of AHP, this paper uses the geometric mean of individual judgments to obtain a combined group judgment. This may help to overcome difficulties arising from a lack of group consensus (Davies, 1994). Other techniques for aggregation include "conceptual aggregation" based on conceptual clustering and case-based learning for real-time (dynamic) decision making (Chaturvedi et al., 1993); the flexible modeling approach based on Bayesian analysis for aggregation of point estimates (Clemen and Winkler, 1993); and aggregation of preference patterns using social choice framework (Dubois and Koning, 1994). Comparative studies on group preference aggregation are reported by Ramanathan and Ganesh (1994) and Perez and Barba-Romero (1995).

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