The Location of a Health Center: A Comment

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Massam and Malczewski (1991) generally concluded that decision support systems (DSS) can contribute to improving the quality of planning. A necessary step, they pointed out, is "to provide clear explanations of the evaluation process" (1991:3).

Their research demonstrated how a particular DSS—the dynamic interactive network analysis system (DINAS)—can be adapted to identify the relative attractiveness of alternative sites given a set of criteria.

Such evaluation problems are complex in that they are subject to risks and uncertainties. Among the complicating factors, the authors stated that "there are no easy or technical solutions to the problems of selecting the criteria which are to be used" (1991:21). Separately, Massam (1991) has argued that decision-makers are responsible for defining the criteria and their relative importance.

An approach offered by Saaty (1980) looks closely at the role of criteria in evaluation problems. Banai-Kashani (1989:686) noted that Saaty's analytic hierarchy process (AHP) "has been shown to be effective in evaluation problems involving multiple and diverse criteria, measurement of trade-offs and with limited data."

The DINAS and the AHP are methods which are friendly to each other. Both balance objectives and outcomes, are interactive and depend on informed judgments. However, it is the role of judgments that is a significant differentiating feature. Whereas the values of decision-makers vary within a fixed range of expectations in the DINAS, the AHP is capable of revealing them. In other words, the AHP can uncover the relative importance of the decision-making criteria.

Determining which of seven alternative sites in the district of Mpika, Zambia, would be the most suitable location for a health care center was the objective of one of the original research problems. Accessibility as measure by six criteria was the basis of the evaluation (see Table 1). Here, the research problem is to deter-

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mine the relative importance of the criteria and to compare the resulting site rankings with those presented by Massam and Malczewski.

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The AHP method proceeds by establishing hierarchial levels that typically consist of objectives at the initial stage and outcomes at the end stage. In the following example, criteria are at the intermediate stage from which the analysis begins.

Pairwise comparison matrices were formed in order to fathom the relative importance of the criteria with respect to the objective of finding the best site. First, all criteria are assumed to be of equal importance. Then the importance of the criteria was interpreted to fit the values which they represent. Massam and Malczewski (1991:13–14) suggested that criteria one through three relate to "effectiveness and equity questions" and the last pertains to "the interests of equity". Consequently, criteria 1, 2 and 3 are taken to be more important than criterion 6. Criteria 4 and 5 are the least important.

Table 1: Evaluation criteria.

1) The average distance travelled to the nearest center.
2) The standard deviation of the average distances.
3) The maximum distance that has to be travelled to reach a center.
4) The population within 12 km of a center.
5) The population within 30 km of a center.
6) The distance to the next nearest center.

In keeping with the AHP, matrices are formed to compare the criteria and the alternative sites. Tables 2 and 3 display the relative weights (or principal eigenvectors) of the criteria and the alternatives as well as the overall consistency of the judgments. The overall rankings are shown in Table 4.

Table 2: Relative weights of criteria.

Criteria	*Equal value*	*Adjusted value*
1	.167	.235
2	.167	.235
3	.167	.235
4	.167	.071
5	.167	.071
6	.167	.153
Consistency ratio		.013

Table 3: Relative weights of alternatives (A–G) criteria.

	Criteria					
Alternative	*1*	2	*3*	*4*	*5*	6
A	.136	.077	.184	.063	.098	.185
B	.042	.239	.062	.063	.056	.185
C	.187	.093	.221	.235	.197	.032
D	.187	.051	.062	.235	.197	.103
E	.068	.026	.026	.021	.058	.103
F	.024	.364	.084	.322	.371	.361
G	.356	.151	.362	.063	.023	.032
Consistency ratio	.075	.031	.075	.036	.068	.051

Table 4: Composite weights.

Alternative	*Equal value*	*Adjusted value*
A	.1238	.1330
B	.1078	.1173
C	.1608	.1533
D	.1392	.1169
E	.0503	.0496
F	.2543	.2154
G	.1645	.2152

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If all the criteria take on equal values then the AHP ranking of the alternatives from best to worst compares favorably with the order of site attractiveness suggested by Massam and Malczewski (1991). They described site F as the best choice; sites C and G as the second choices; and sites B and E as the least favored alternatives.

But, if one accepts the relative importance of the criteria as determined by the values they represent then the AHP and the DINAS rankings differ somewhat. However, the AHP rankings show, again in agreement with the authors (1991) "that F and G are the most appropriate sites for a new health care center".

Since "different algorithms, variable scaling factors and uses of weights lead to different outcomes" (Karni *et al.*, 1990) we return to the question: how well does the DINAS provide clear explanation of the evaluation process? In our view, the

DINAS provides ambiguous results. To declare site F, alone, as the best choice is to forego the significance of the values underlying the decision-making criteria.

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