

Supplementary Material

Analytic Network Process

The Analytic Network Process (ANP) is based upon the supermatrix approach, a concept parallel to a Markovian chain process (Saaty and Vargas 1998; Saaty 2016). Pairwise comparisons among elements in an ANP structure are performed using Saaty's (2001) *fundamental scale* — a 1 to 9 scale, where 1 represents equal importance and 9 indicates that the first criterion is extremely more important than the second one. For each cluster, the respective importance weights in a ratio scale for all the elements are obtained through the computation of the principal eigenvector.

The eigenvector solutions are arranged into the unweighted supermatrix, \mathbf{W} , to capture the outcome of dependence and feedback within and between clusters. Formally, \mathbf{W} comprises a set of block matrices, \mathbf{W}_{ij} , each composed of column elements, $\mathbf{W}_{ij} = \{e_{ij1}, e_{ij2}, \dots, e_{ijn}\}$ that correspond to the respective eigenvector solutions ($\mathbf{W}_{ij} = 0$ when there are no linkages between elements of two clusters); formally:

$$\mathbf{W} = \begin{bmatrix} \mathbf{W}_{11} & \mathbf{W}_{12} & \dots & \mathbf{W}_{1m} \\ \mathbf{W}_{21} & \mathbf{W}_{22} & \dots & \mathbf{W}_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{W}_{n1} & \mathbf{W}_{n2} & \dots & \mathbf{W}_{nm} \end{bmatrix}$$

Synthesis entails normalizing each column of the un-weighted supermatrix, \mathbf{W} , to obtain a weighted supermatrix in which columns sum to unity — this is referred to as column stochastic or simply a stochastic supermatrix (a condition for its powers to converge to a steady state). \mathbf{W} is then raised to powers to attain convergence to a steady state of column values. At this point the so-called limit supermatrix includes the global weights, which are commensurate to the relative influence of each element on every other one; formally:

$$\lim_{k \rightarrow \infty} \mathbf{W}^k$$

Confusion matrix

Table A1: Confusion matrix of classified census blocks of Mexico City for the evaluation of the accuracy and reliability of MEGADAPT's output (LV = lower vulnerability; HV = higher vulnerability).

Simulated class	Actual class	
	LV	HV
LV	1725	141
HV	450	112