Supplementary Information 4

- **TOPSIS Analysis Method**

For evaluating all the solution sets according to the economic criteria (i.e., IT), we use the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method.

By exploiting a weighted decision matrix in which M alternatives are evaluated in terms of N weighted criteria it's possible to identify an ideal best-case solution and an ideal worst-case solution; the alternatives are then ranked according to the Euclidean distance from the ideal and non-ideal solutions.

The weighted decision matrix (C) is composed by a total of 255 possible alternatives M (M = 1, ...,255; i.e., all the UHI-mitigation individual solutions and solution sets) and the IT criteria N (N = 1, 2). Both the weight of the criteria (W_N) and the weight of alternatives (W_{MN}) are obtained from the AHP analysis.

$$C = \begin{pmatrix} W_1 W_{1,1} & W_2 W_{1,2} & \dots & W_N W_{1,N} \\ W_1 W_{2,1} & W_2 W_{2,2} & \dots & W_N W_{2,N} \\ W_1 W_{3,1} & W_2 W_{3,2} & \dots & W_N W_{3,N} \\ W_1 W_{4,1} & W_2 W_{4,2} & \dots & W_N W_{4,N} \\ W_1 W_{5,1} & W_2 W_{5,2} & \dots & W_N W_{5,N} \\ \dots & \dots & \dots & \dots \\ W_1 W_{M,1} & W_2 W_{M,2} & \dots & W_N W_{M,N} \end{pmatrix} \tag{10}$$

For simplicity's sake the elements of the weighted decision matrix C (i.e., $W_N W_{MN}$) will be referred as v_{MN} with N being the N^{th} criterion and M being the M^{th} alternative.

Subsequently, the ideal best-case alternative M^* is defined as an alternative which contains the highest values of the criteria considered good for the objective (N^+), and the lowest value of the criteria considered bad for the objective (N^-) (Eq 11). In our case the ideal solution would possess the highest value for time (time is structured in the polls to be a positive criterion since experts are asked to choose the solution that require the less amount of time), and the lowest value for investment.

$$M^* = \{(\max v_{MN^+} \; | N^+ \in N), (\min v_{MN^-} \; | N^- \in N) | M = 1,2,\dots,256 \} \tag{11}$$

$$M^* = \{v_{1*}; v_{2*}\}$$

Similarly, the ideal worst-case alternative M^- is defined as an alternative which contains the lowest values of the criteria considered good for the objective (N^+), and the highest value of the criteria considered bad for the objective (N^-) (Eq 12). In our case the ideal solution would possess the lowest value for time, and the highest value for investment.

$$M^- = \{(max \; v_{MN^-} \; | N^- \in N), (min \; v_{MN^+} \; | N^+ \in N) \; | M = 1,2,\dots,256 \tag{12}$$

$$M^* = \{v_{1-}; v_{2-}\}$$

Once obtained M^* and M^-, we calculate the Euclidean distance to measure the distance of each solution from both the ideal best-case solution (d_{M^*}) and worst-case solution (d_{M^-}) (Eq 13-14)

$$d_{M*} = \sqrt{\sum_{i=1}^{N} (v_{Nj} - v_{j*})^2} \tag{13}$$

$$d_{M-} = \sqrt{\sum_{i=1}^{N} (v_{Nj} - v_{j-})^2} \tag{14}$$

Then it's possible to calculate the relative closeness of the M alternative to the ideal best-case solution (C_{M*}) (Eq 15)

$$C_{M*} = \frac{d_{M-}}{d_{M*} d_{M-}} \tag{15}$$

The relative closeness can vary between zero and one. C_{M*} equals zero if the alternative corresponds to the worst-case solution, while C_{M*} equals one if the alternative corresponds to the ideal best-case alternative. All the 255 alternatives are ranked according to the value of C_{M*}.