

Sweeden Game

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Compromise Approach with Specific Numbers

Below is an example illustrating specific numbers based on a compromise method. The baseline is set by the Shapley value, and adjustments are made if the cooperation cost differs from the sum of the baseline values.

1. Baseline (Shapley Value)

Region (Team)	Individual Construction Cost	Shapley Value
A	219.5	200.1
H	170.8	107.1
K	108.1	66.1
L	158.8	103.7
M	208.1	169.4
T	219.8	191.8

1. Adopting the Shapley Value as the Baseline: Use the Shapley value—calculated as the average additional (avoidable) cost incurred based on the order of participation—as the basic cost responsibility for each region. This method accounts for the benefits of joining later in the sequence, providing a fair baseline.
2. Provision for Negotiation Adjustments: Since relying solely on the Shapley value can lead to discrepancies (for example, when sub-coalitions such as teams H, K, and L face a surplus cost difference compared to the actual partnership cost), the following measures can be introduced:
3. For specific sub-groups, like the coalition of H, K, and L, share the difference between the Shapley-based cost and the actual cost equally among the members. Introduce adjustment factors based on each region’s negotiation power, risk profile, or market conditions to achieve a balanced allocation.
Implementing a Step-by-Step Negotiation Process:
4. First, present the basic proposal based on the Shapley value to all regions. Then, hold a joint negotiation meeting where each region can provide input and propose adjustment coefficients (e.g., based on population, water demand, or other relevant factors). Consider additional incentives, such as future priority participation in additional joint projects, to facilitate an agreement that is both fair and acceptable to all.

2. Adjusted Allocation under the Compromise Method

For instance, consider a coalition of regions H, K, and L. Their total baseline (Shapley) cost is calculated as:

$107.1 + 66.1 + 103.7 = 277.0.$

Assume the actual cooperative construction cost for these three is 272.6.
This results in a surplus of:

$277.0 - 272.6 = 4.4.$

If this surplus is evenly distributed, each region reduces its cost by:

$4.4 / 3 \approx 1.47.$

Thus, the adjusted cost allocation becomes:

Region (Team)	Baseline (Shapley Value)	Adjustment	Adjusted Cost
A	200.1	0	200.1
H	107.1	-1.47	105.63
K	66.1	-1.47	64.63
L	103.7	-1.47	102.23
M	169.4	0	169.4
T	191.8	0	191.8

This compromise method uses the Shapley value as a fair baseline for cost allocation, then adjusts specific groupings based on the actual cooperation cost. Such a process facilitates negotiations and helps to present a cost-sharing plan acceptable to all regions.