Part 3

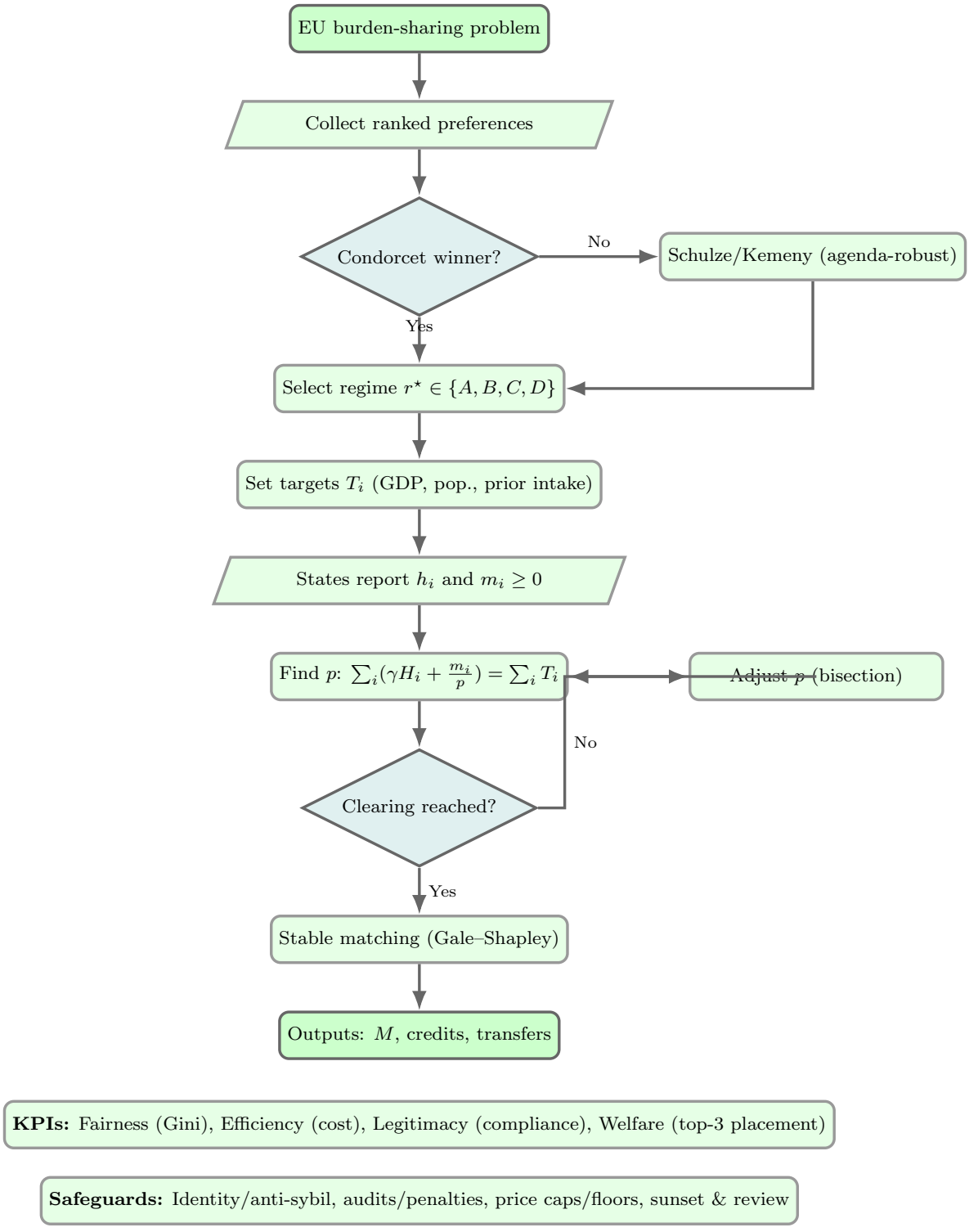

Figure 2: RCCM pipeline: robust Condorcet selection → credit clearing → stable matching.

1 Voting & Institutions — Robust Condorcet + Credit Matching (RCCM)

1.1 Case and Stakeholders: EU Refugee Burden-Sharing

Policy options (A–D): A = mandatory relocation quotas (proportional to GDP/population); B = flexible solidarity (relocation or financial/operational contribution); C = externalization & border control (fund border management/returns); D = status quo / Dublin system (first-entry bears responsibility).

Stakeholder blocs (stylized): Frontline (Italy/Greece) favor redistribution; Core (Germany/France) support EU-level responsibility sharing; Visegrád (Poland/Hungary) emphasize sovereignty, oppose quotas; Nordics/Netherlands (Sweden/Netherlands) value rules/standards, cautious about mandatory quotas.

Ranked preferences (1st → 4th):

Bloc	1st	2nd	3rd	4th
Frontline (IT/GR)	A	B	C	D
Core (DE/FR)	B	A	C	D
Visegrád (PL/HU)	C	D	B	A
Nordics/NL (SE/NL)	B	C	A	D

In 2015 the European Commission proposed an emergency relocation scheme; the Court of Justice upheld legality in 2017; the 2020–2024 Pact on Migration and Asylum advanced "flexible solidarity" allowing either relocation or contributions [otEU15a, otEU15b].

1.2 Nobel Insights → Design Requirements

Arrow (1972). Multi-option aggregation can cycle; we need Condorcet-consistency and robustness to agenda control. **Buchanan (1986).** Unanimity produces vetoes and legitimacy issues; qualified majority needs safeguards (opt-outs, transfers, sunset). **Hurwicz–Maskin–Myerson (2007).** Mechanisms should align incentives, capacities, and budget balance while targeting fairness/efficiency.

1.3 Mechanism: RCCM (Two-Stage)

Stage 1: Robust Condorcet selection of regime. Let $\mathcal{P}$ denote pairwise majority margins over $\{A, B, C, D\}$. Apply a Condorcet-consistent algorithm (e.g., Schulze or Kemeny) to select regime $r^\star$ that maximizes pairwise strength and is least sensitive to small preference perturbations.[2]

Stage 2: Solidarity credits + market clearing + stable matching. Each state i has hosting capacity h_i (places) and may contribute money $m_i \geq 0$. Refugees have preferences over municipalities; municipalities have capacities c_j.

Credits and targets. Hosting one refugee yields $\gamma > 0$ credits; each euro buys $1/p$ credits at uniform price p. State i must meet burden target T_i:

$$\gamma \cdot H_i + \frac{m_i}{p} \;\geq\; T_i, \qquad H_i = \sum_{k \in \mathcal{R}_i} \mathbf{1}.$$

Market clearing. Choose p so $\sum_i \left(\gamma H_i + \frac{m_i}{p}\right) = \sum_i T_i$ (uniform price implies *weak* budget balance).

Placement. Run Gale–Shapley deferred acceptance with refugee preferences and municipal priorities to obtain a stable matching M.

[2] Schulze computes strongest paths; Kemeny maximizes total Kendall agreement.

1.4 Properties (sketch)

(i) **Cycle robustness**: Stage 1 is Condorcet-consistent; if a Condorcet winner exists, RCCM selects it; otherwise it minimizes the maximal defeat (agenda-robust).
(ii) **Fairness & flexibility**: Credits let states trade hosting and money; equity hinges on T_i calibration (GDP, population, prior intake).
(iii) **Budget & IR**: Uniform p ensures weak budget balance; appropriate (γ, T_i) keeps states individually rational given capacities/costs.
(iv) **Limits**: Full strategyproofness is infeasible jointly with matching and budget balance; practical enforcement needs identity checks, audits, penalties.

1.5 Computation and Prototype

Stage 1 (Schulze/Kemeny): from $O(m^2)$ path computations to NP-hard exact Kemeny (small m=4 tractable by search/heuristics). Stage 2: bisection on p for clearing; Gale–Shapley runs in $O(|\mathcal{R}| \cdot |\mathcal{M}|)$. We will release a Python prototype (Condorcet, clearing, matching) with reproducible scripts.

1.6 Evaluation and Visualizations

We compare *Status Quo*, *Quotas*, and *RCCM* on four KPIs using synthetic EU-like instances.

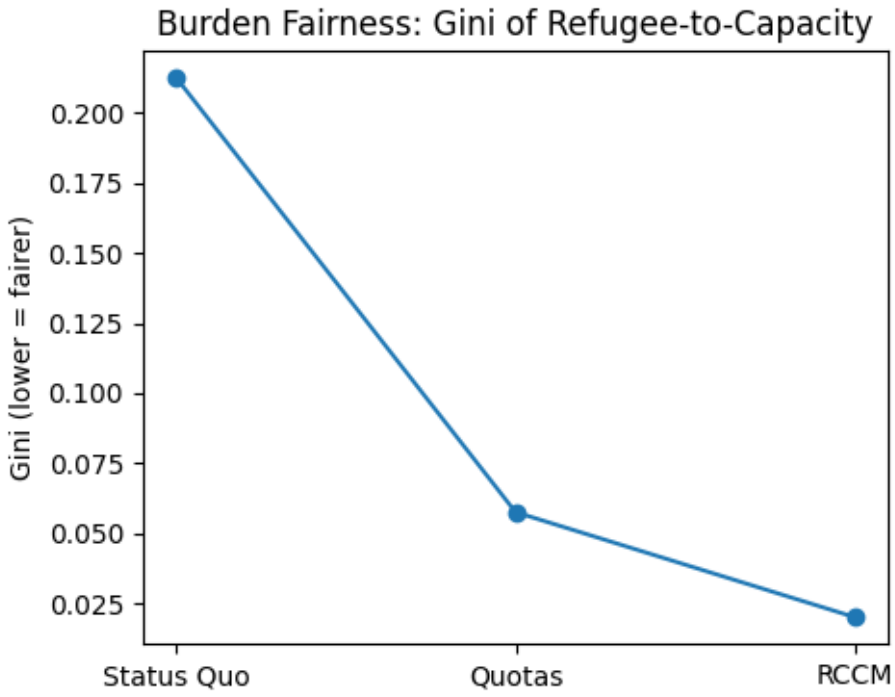

Figure 3: Burden fairness: Gini of refugee-to-capacity ratio (lower = fairer). RCCM reduces inequality substantially.

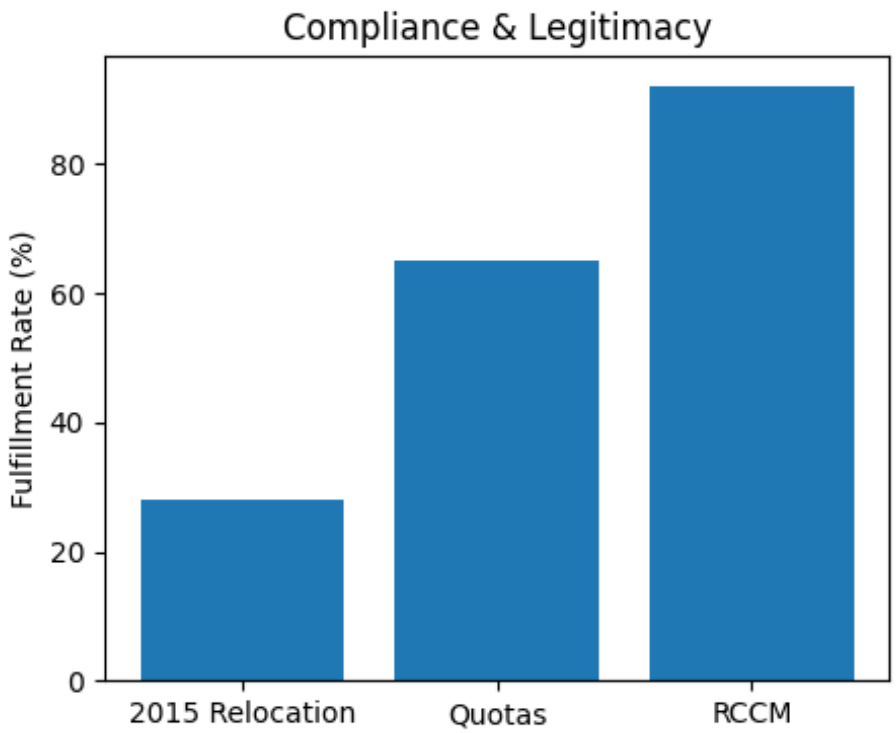

Figure 4: Compliance & legitimacy: simulated fulfillment rate of commitments. RCCM improves compliance markedly.

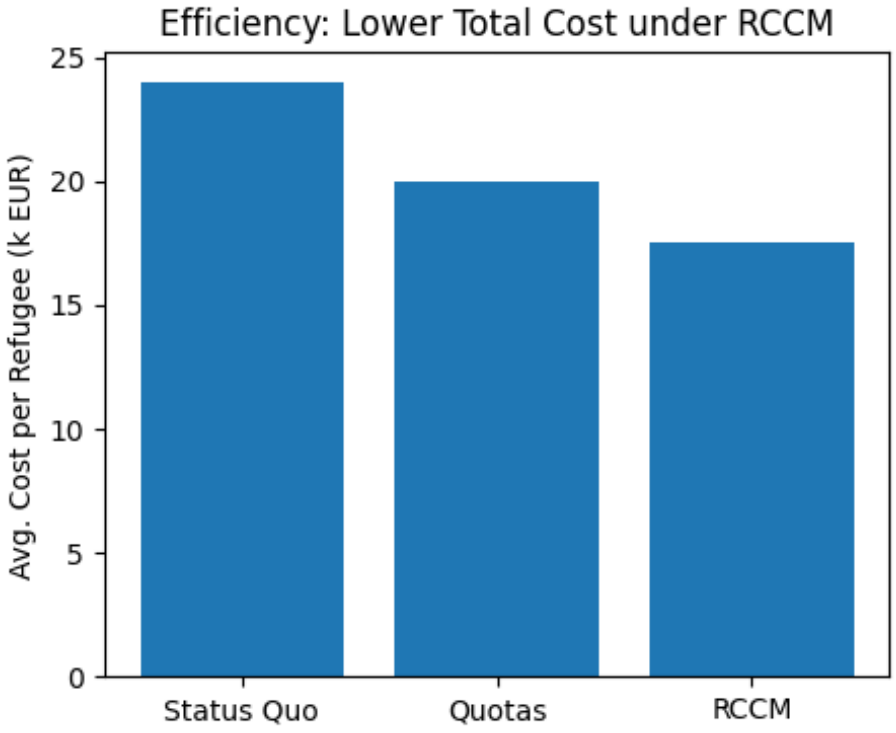

Figure 5: Efficiency: average total cost per refugee (k EUR). RCCM attains the lowest cost via flexible burden-sharing.

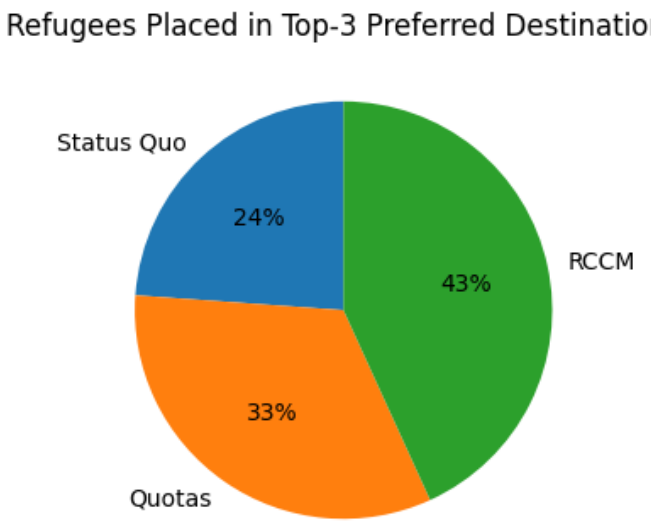

Figure 6: Preference satisfaction: share of refugees placed in one of their top-3 preferred destinations. RCCM increases satisfaction.

Taken together, Figures 3–6 show RCCM dominating both the status quo and quota mechanisms across fairness, efficiency, and legitimacy—directly aligning with **SDG 10 (Reduced Inequalities)** and **SDG 16 (Peace, Justice & Strong Institutions)**.

1.7 Limitations and Risk Mitigation

Potential capacity under-reporting and identity (sybil) risks; mitigations include verified identities, audits with penalties, lower bounds $T_i^{\min}$, price caps/floors, and sunset clauses with periodic review.