SMART-CPR: SELF-ORGANISATION AND SELF-GOVERNANCE IN THE SHARING ECONOMY

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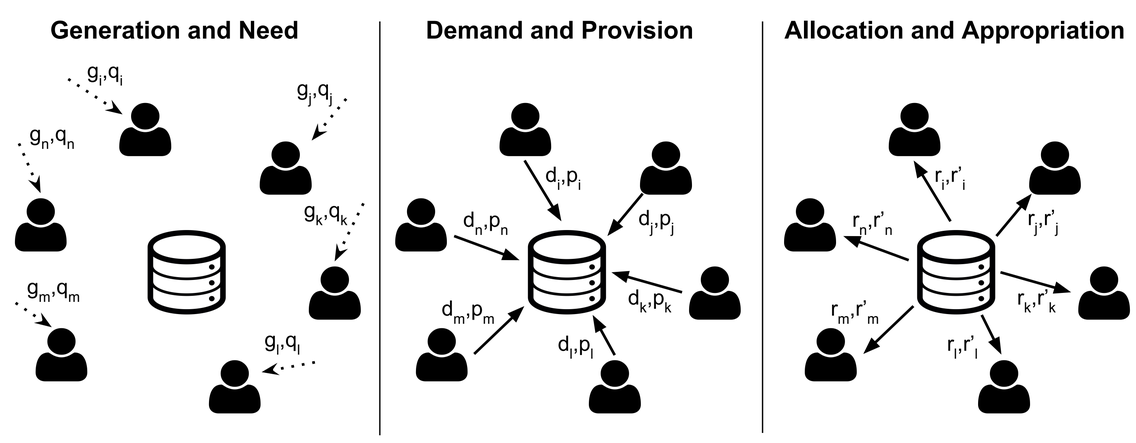
DISTRIBUTED RESOURCE ALLOCATION - *LPG'*

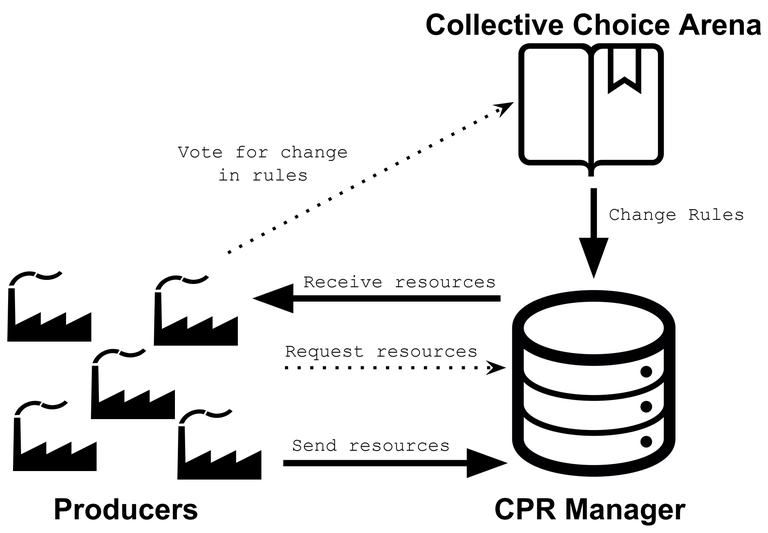
- Producers independently operate in a market of common manufactured widgets
- Over time, producers receive demands for products (q) and keep a capacity of production output (g)
- Producers cooperate by distributing offer (p) and demand (d) in a common pool of services
- Resources of industrial supply and demand are distributed (r) among producers, following stipulated rules



QUESTIONS

- How to ensure **efficient, fair, inclusive and sustainable** ways to distribute services among producers?
- What **rules and norms** should govern the interactions and transactions?
- **Who** should determine the stipulated rules?
- How to deal with **abuses** and **non-compliance** with the rules?

ACTORS MODEL: SMART-CPR



Producer

- Responsible for mediating provision and demands of resources to the CPR Manager
- Participant of the Collective Choice Arena, being able to cast votes and update CPR Manager's policies to it's own benefit

CPR Manager

- Responsible for fast decision making of resource allocation
- Smart-Contract define policy and rules for responses for resources request
- Blockchain ledger stores producers participation and behaviour

Collective Choice Arena

- Compute producers' votes for change on CPR Manager rules
- Issue new smart-contracts to be used as policy for CPR Manager

POLICY MAKING - SMART-CONTRACT

Rescher's legitimate claims of justice is used as metric to evaluate producer participation in the system (according to the public ledger):

Canons of equality	$\phi_i^1 = R_i$
	$\phi_i^2 = \begin{cases} (1-\alpha)\cdot\phi_i^2 + \alpha & \text{if accepted req.} \\ (1-\beta)\cdot\phi_i^2 & \text{if denied req.} \end{cases}$
Canon of needs	$\phi_i^3 = D_i$
Canon of productivity	$\phi_i^4 = P_i$
Canon of effort	$\phi_i^5 = CurTime - JoiningTime$
Canon of social utility	$\phi_i^6 = Status(i)$

Upon a request for resource, a weighted sum of the claims is computed and a response is evaluated based on a smart-contract policy:

Algorithm Smart-Contract

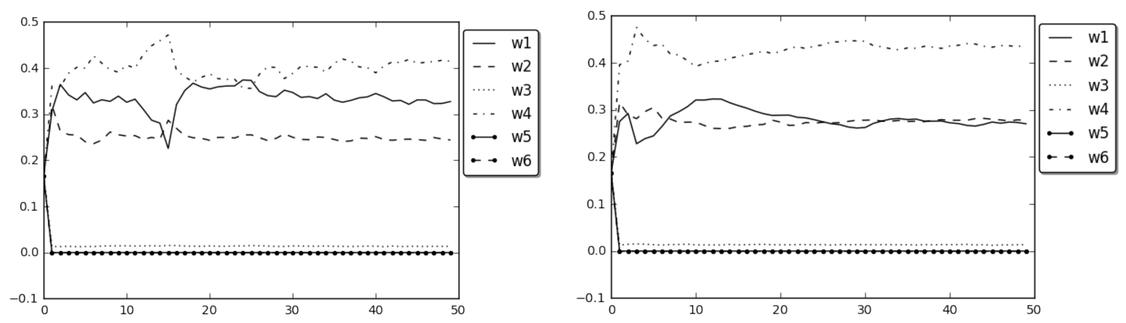
Require:
$W = [w_1, w_2 \dots w_n]$ ▷ Weights for different claims
S_t ▷ Score Threshold

Smart-contract EVALUATEREQUEST
$\Phi_i = [\phi_i^1, \phi_i^2 \dots \phi_i^n] \leftarrow$ GETMERIT($Ledger, UserId$)
$S_i = \sum_{j=1}^{|C|} \left(w_j * \phi_i^j\right)$
if $S_i \geq S_t \wedge Pool \geq Request$ **then**
return *accepted*
else
return *denied*
end if
end Smart-contract

RESULTS

Experiments observe two scenarios: (a) homogeneous full compliant populatoin and (b) a mix of compliant and non-compliant agents.

CANON'S WEIGHTS SELF-ORGANISATION



(a) Full compliant case (b) Mixed population case

- Agents are able to self-organise the relevance of weights in order to benefit the majority of the network

RESOURCE DISTRIBUTION RESULTS

	Scenario A	Scenario B	
	Full Compliance	Compliant Agents	Non Compliant
Physical Facts			
Demand	4096.49 ± 14.24	4090.10 ± 23.12	4096.40 ± 8.87
Accrued	2730.12 ± 18.00	3864.74 ± 48.35	454.72 ± 14.71
Generated	2730.17 ± 17.85	2726.43 ± 15.67	2732.29 ± 18.09
Allocated	2730.12 ± 18.00	3838.11 ± 47.41	111.71 ± 14.65
Withheld	0.00 ± 0.00	26.63 ± 3.40	343.01 ± 7.01
Analytical Facts			
Satisfaction	0.6493, ±0.0881	0.98 ± 0.02	0.00 ± 0.00
Resources/Need	0.6657 ± 0.0050	0.945 ± 0.0119	0.110 ± 0.0047
Gini Index R/N	0.0038	0.00699	0.01818

- Equity is achieved in scenarios with full-compliance
- In mixed scenarios, compliant agents are prioritised and have increased satisfaction