



May I? Enabling the sharing of private charging infrastructure

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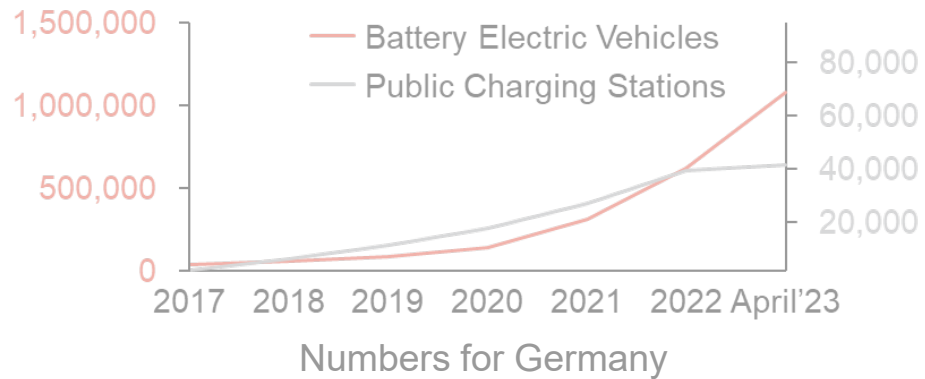
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Agenda

1. Motivation & Objective
2. Wallbox Sharing
3. Research Questions
4. Related Research
5. Approach
6. Results
7. Conclusion

Research Motivation & Objective

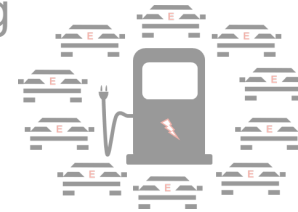
Motivation



- Decarbonizing transport via E-mobility
- Charging infrastructure rollout lags behind

Challenges

- Increasingly more vehicles share a charging point

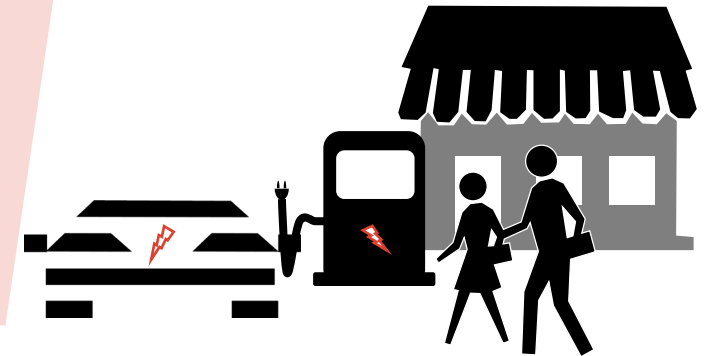


- Ensuring customers' satisfaction



Objective

- Make private charging infrastructure (wallboxes) publicly available



Statista (2023)

Wallbox Sharing

Host

- makes wallbox available to the public
- sells charging electricity to “chargee”

Chargees

- use wallbox
- pay host

Optional: Sharing platform provider
enables digital:

- communication
- reservation/booking
- payment





RQ1: Under what conditions are hosts willing to share their wallboxes and chargees to use them?

RQ2: What are the evaluation criteria for wallbox sharing concepts from the perspective of both hosts and chargees?

Selection of Related Research (1/2)

Aihua et al. (2022), Yunfei et al. (2017)

- Propose blockchain-based smart contracts to facilitate sharing process of wallboxes in China

Xiaoyuan et al. (2018)

- Developed sustainable and efficient business models for wallbox sharing in China

Zhao et al. (2020)

- Investigated pricing strategies for wallbox sharing in non-cooperative game model in China

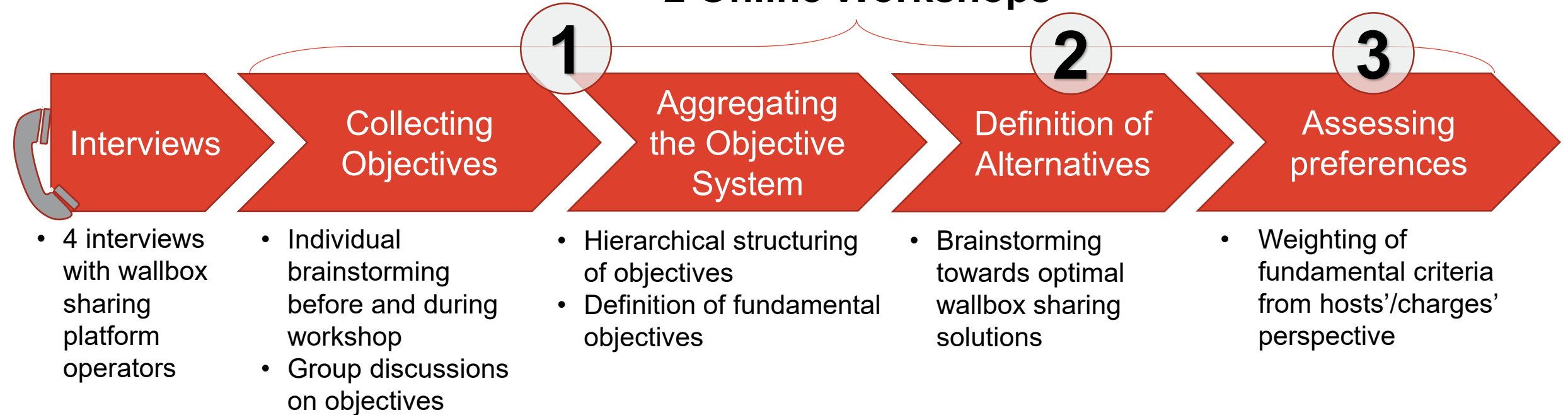
Funk et al. (2021)

- Suggest and conceptualize public marketplace for wallbox capacity

Fabianek and Madlener (2022) — Paper in preparation

- We focused on stakeholders in Germany
- Achieved user perspective through 2 workshops
 - 5 BEV drivers without own wallbox (chargee perspective)
 - 6 BEV drivers with own wallbox (host perspective)
- Investigation of objective systems and preferences of chargees and hosts

2 Online Workshops

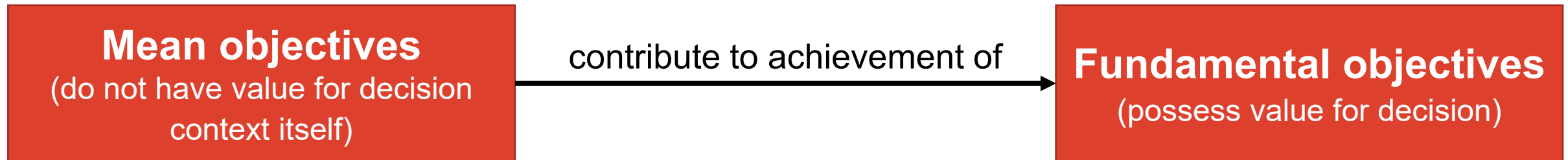


Evaluation of different wallbox sharing alternatives from hosts'/chargees' perspective


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Approach (2/4): Value-Focused Thinking

- Method to identify and structure objectives of decision-makers
- Decision-makers' values as driving forces for decision-making
 - Formulation of objectives for decision context

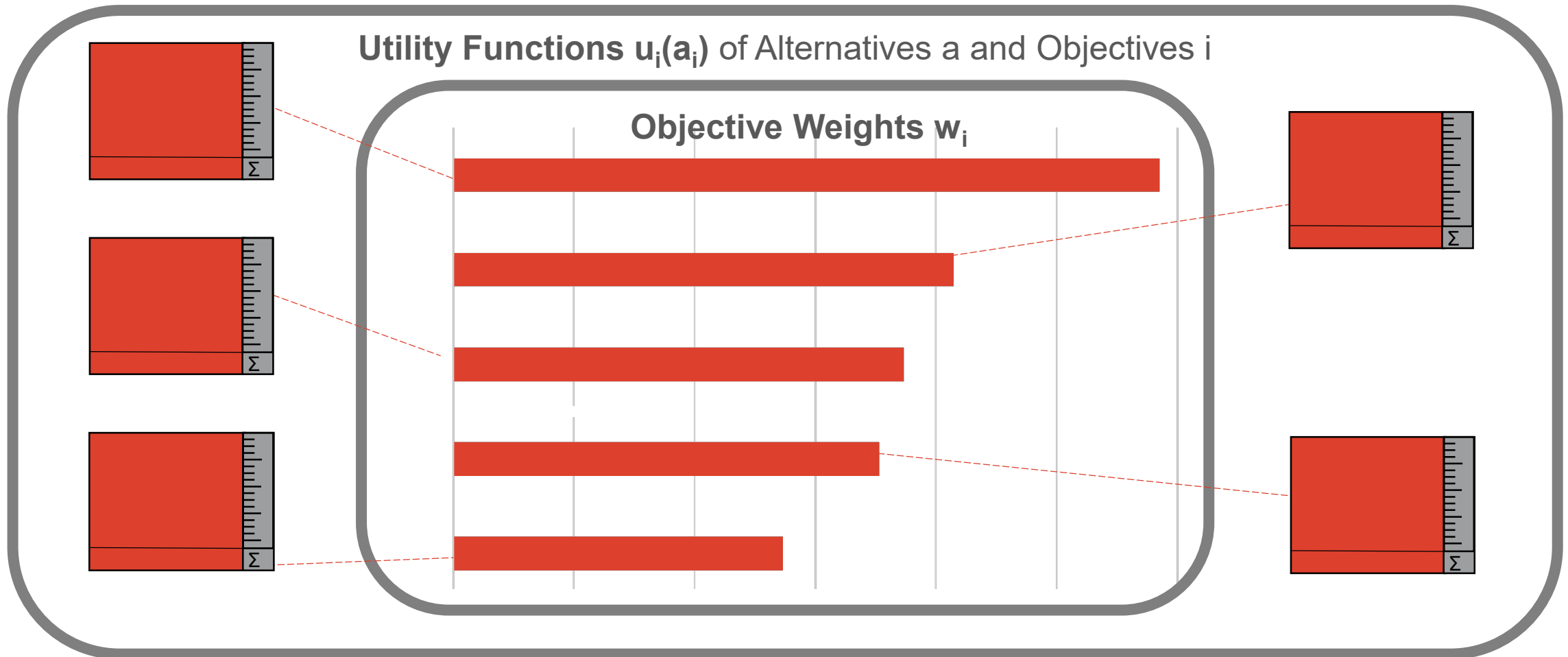


Keeney (1976, 1992, 2012)

- Identification of possible (functional) components for wallbox sharing
 - Individual brainstorming and group discussion
 - Concrete alternatives
- 
- Multi-Criteria Decision-Making (MCDM) process applied
 - Jointly developed objectives individually weighted by decision-makers

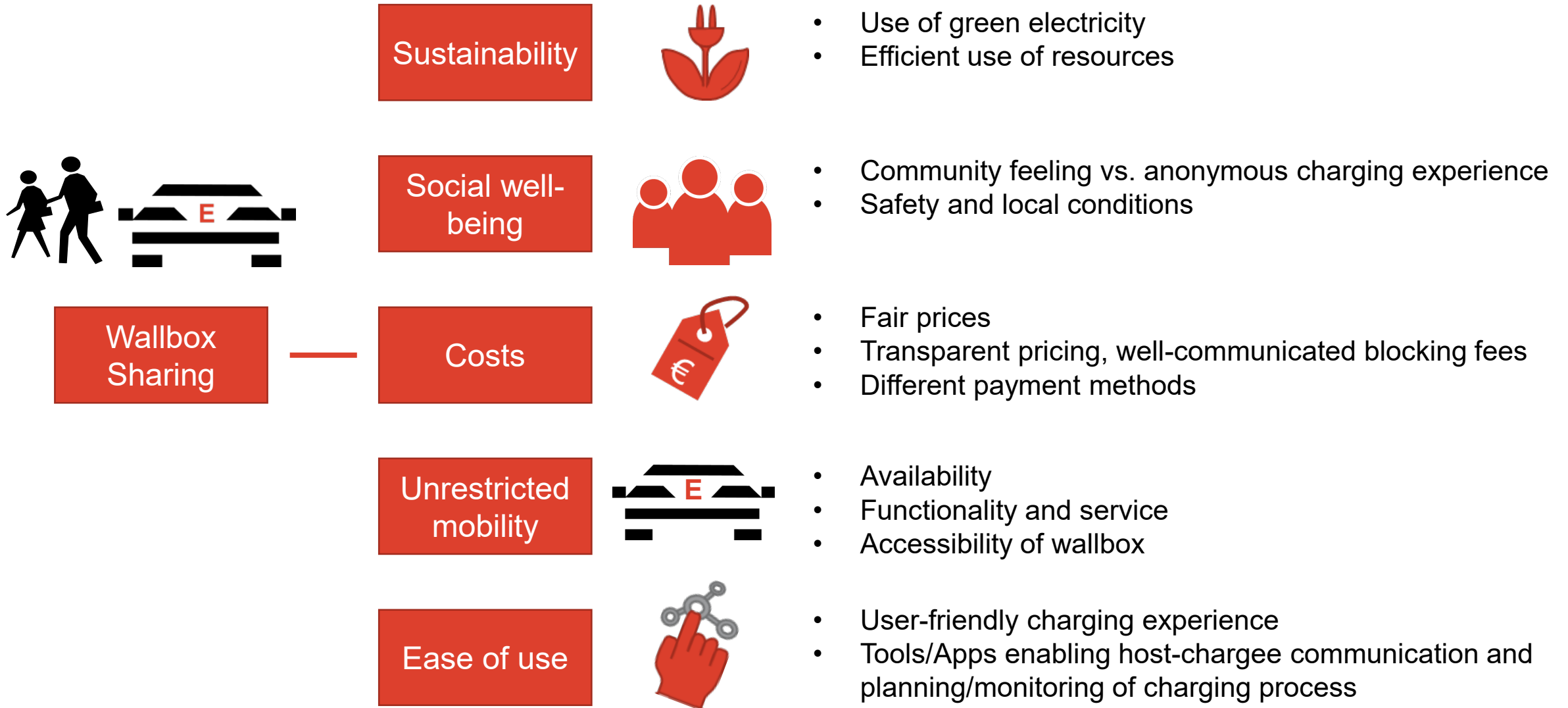
Approach (4/4): Evaluation of Alternatives

$$\text{perceived quality of wallbox sharing alternative} = \sum_{i=1}^n w_i \cdot u_i(a_i)$$



Fishburn (1979) and Keeney and Raiffa (1976)

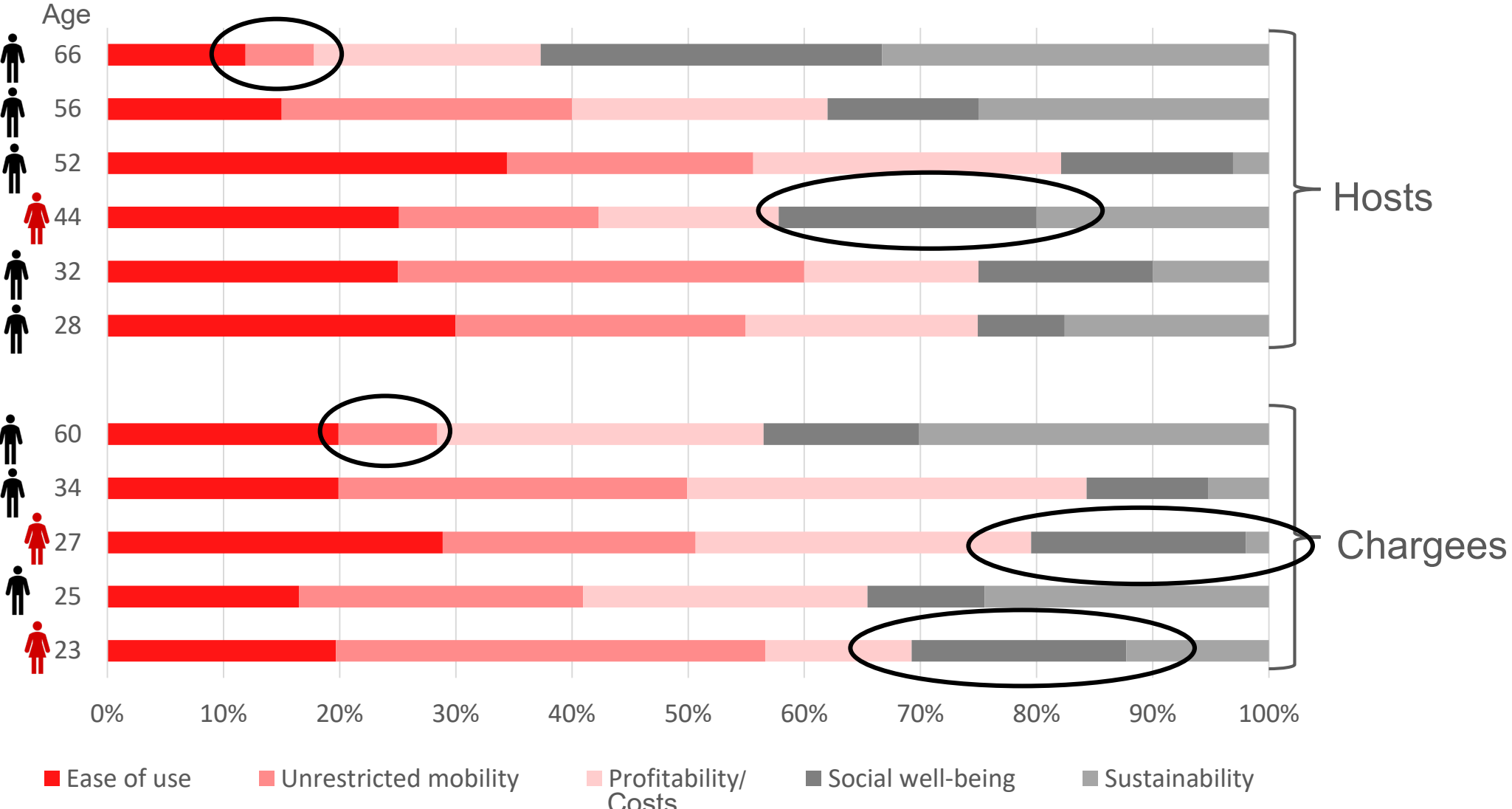
Results (1/5): Objective System (Chargees)



Results (2/5): Objective System (Hosts)



Results (3/5): Assessing Preferences



Two main alternatives conceivable: Supra-regional vs regional

- Differing in terms of:



pricing



start of charging process



booking/agreeing on time slots



payment

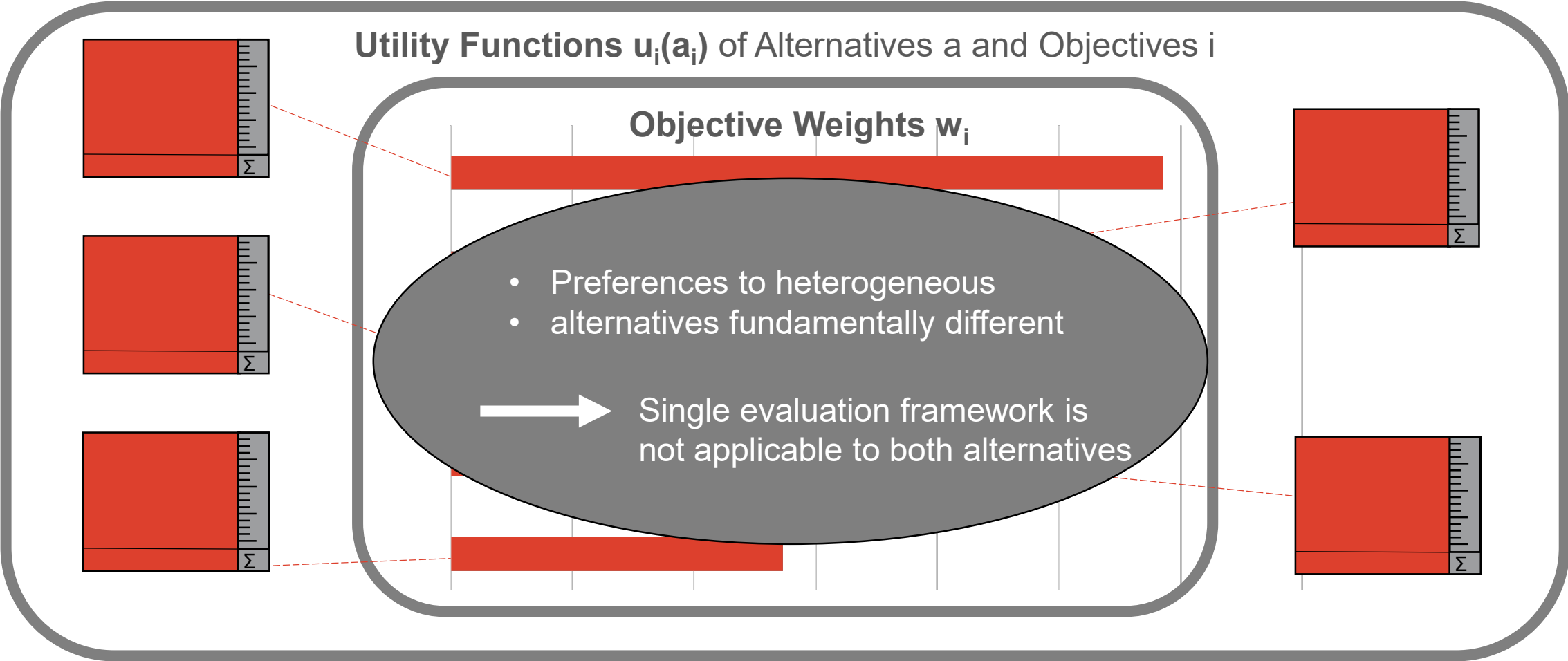


contact between host and chargee

Details in
backup slides

Approach (5/5): Evaluation of Alternatives

$$\text{perceived quality of wallbox sharing alternative} = \sum_{i=1}^n w_i \cdot u_i(a_i)$$



Conclusion

- Five fundamental objectives relevant for wallbox sharing concepts:
 - Sustainability, social well-being, profitability/costs, unrestricted mobility, ease of use
- Two main concepts for wallbox sharing are conceivable:
 - Regional vs supraregional
- Heterogeneous priorities determined for both hosts and chargees
- Hypotheses for future research:
 - Different gender, different priorities?
 - Retirees accept higher levels of restricted mobility?
 - Profitability not important for hosts?
- Online-Experiment with representative sample (n>1000) planned

References

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Thank you for your kind attention!
Any questions?



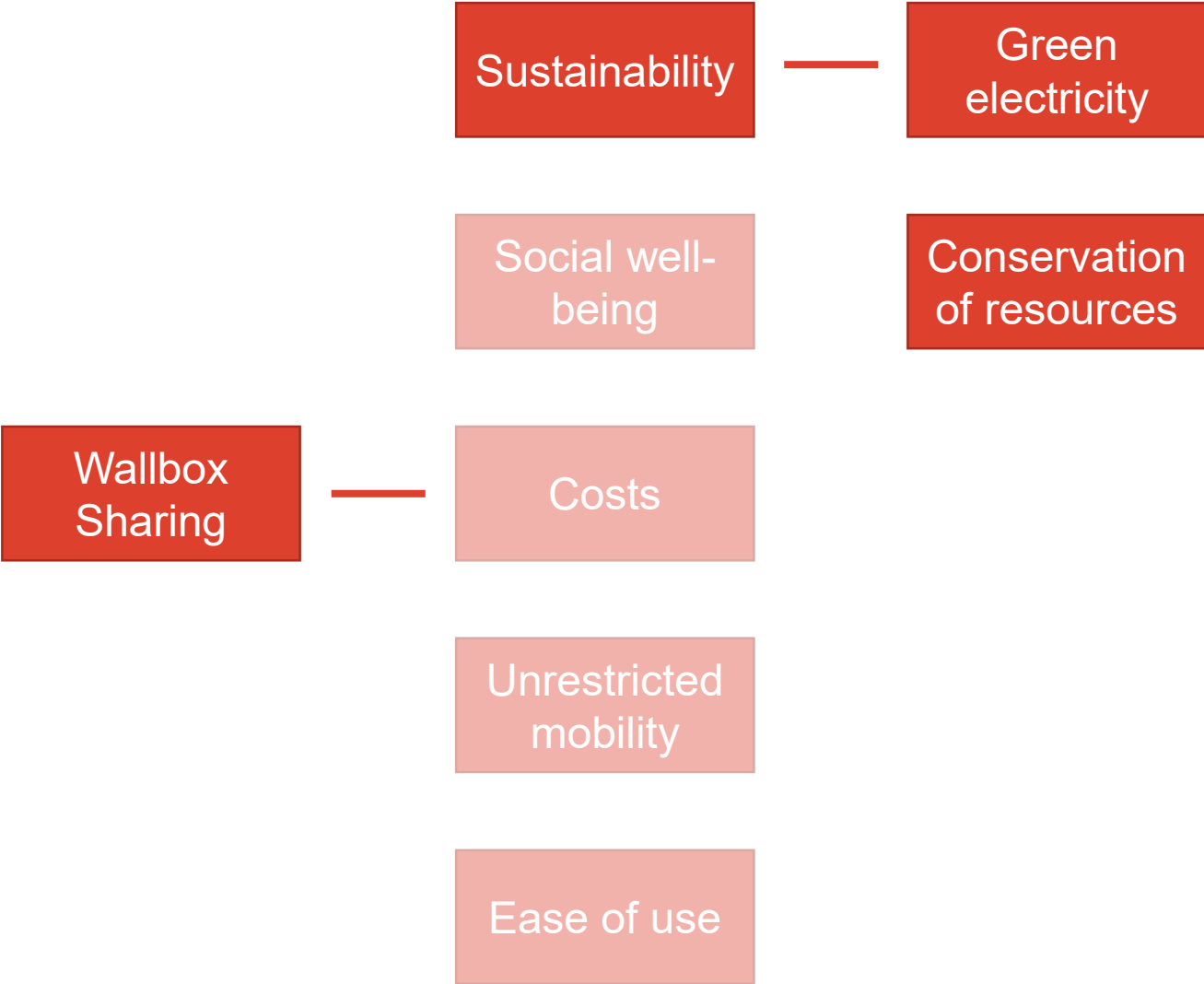
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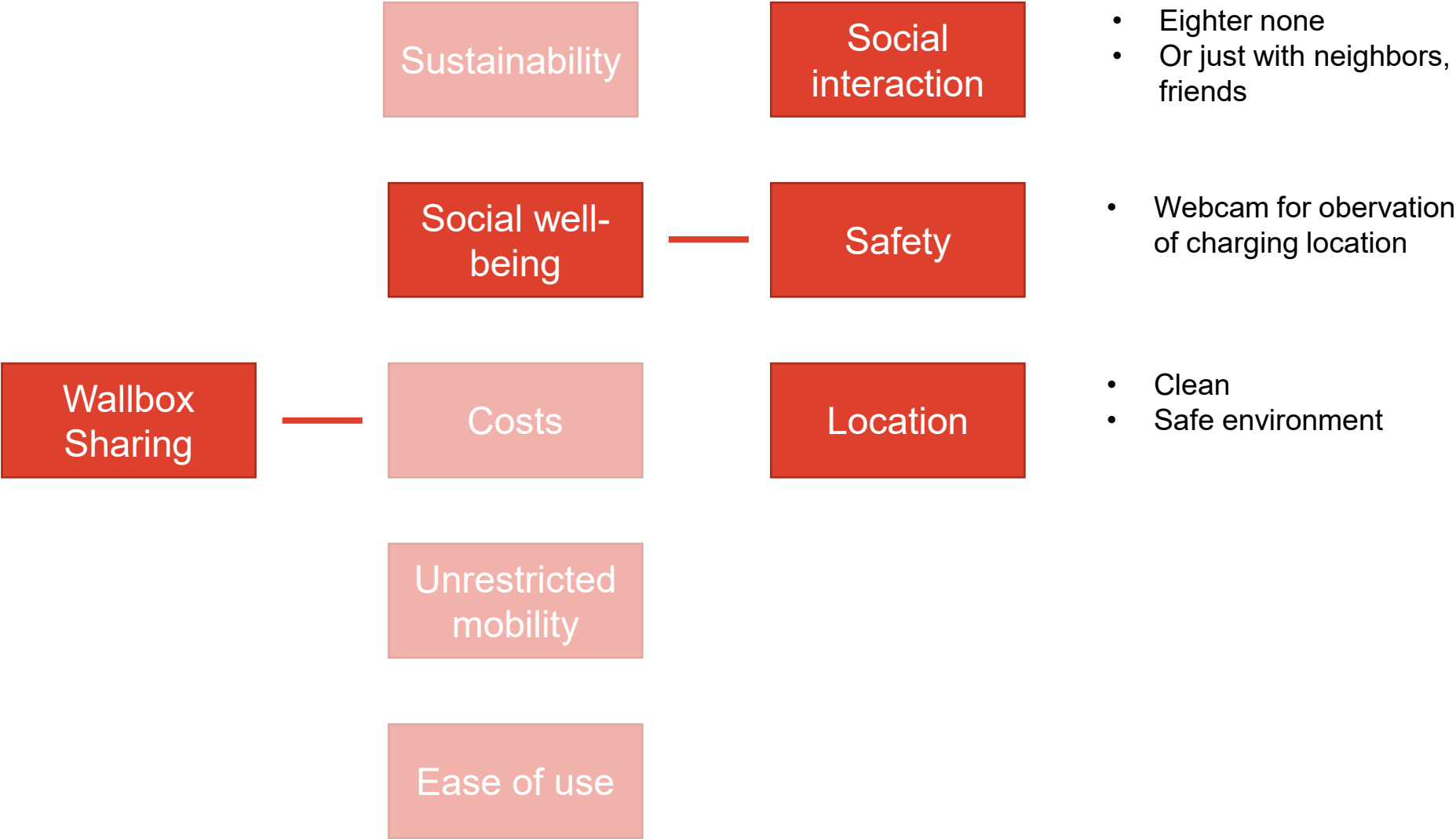
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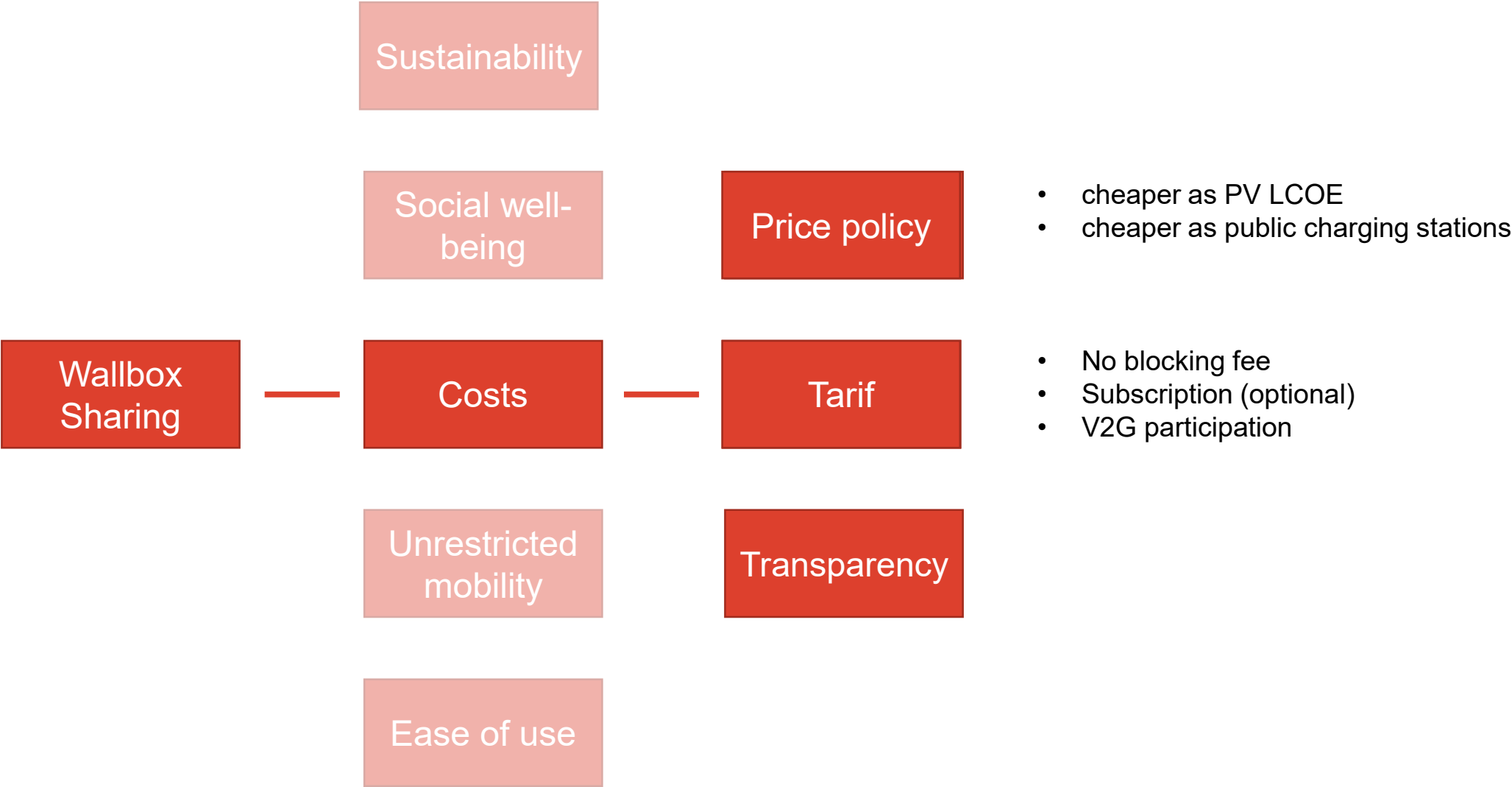
Objective system (chargees) - Sustainability



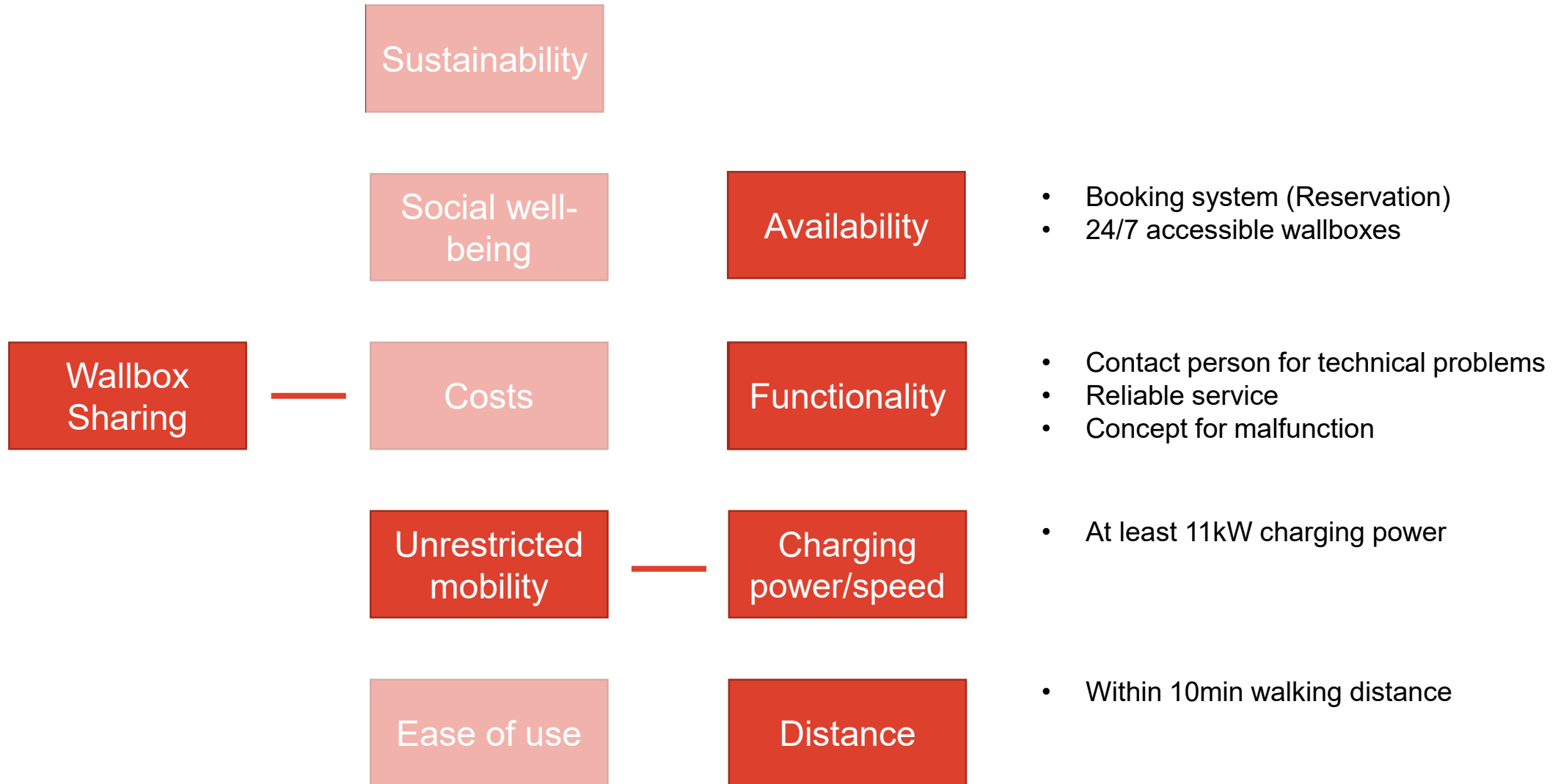
Objective system (chargees) – Social Well-being



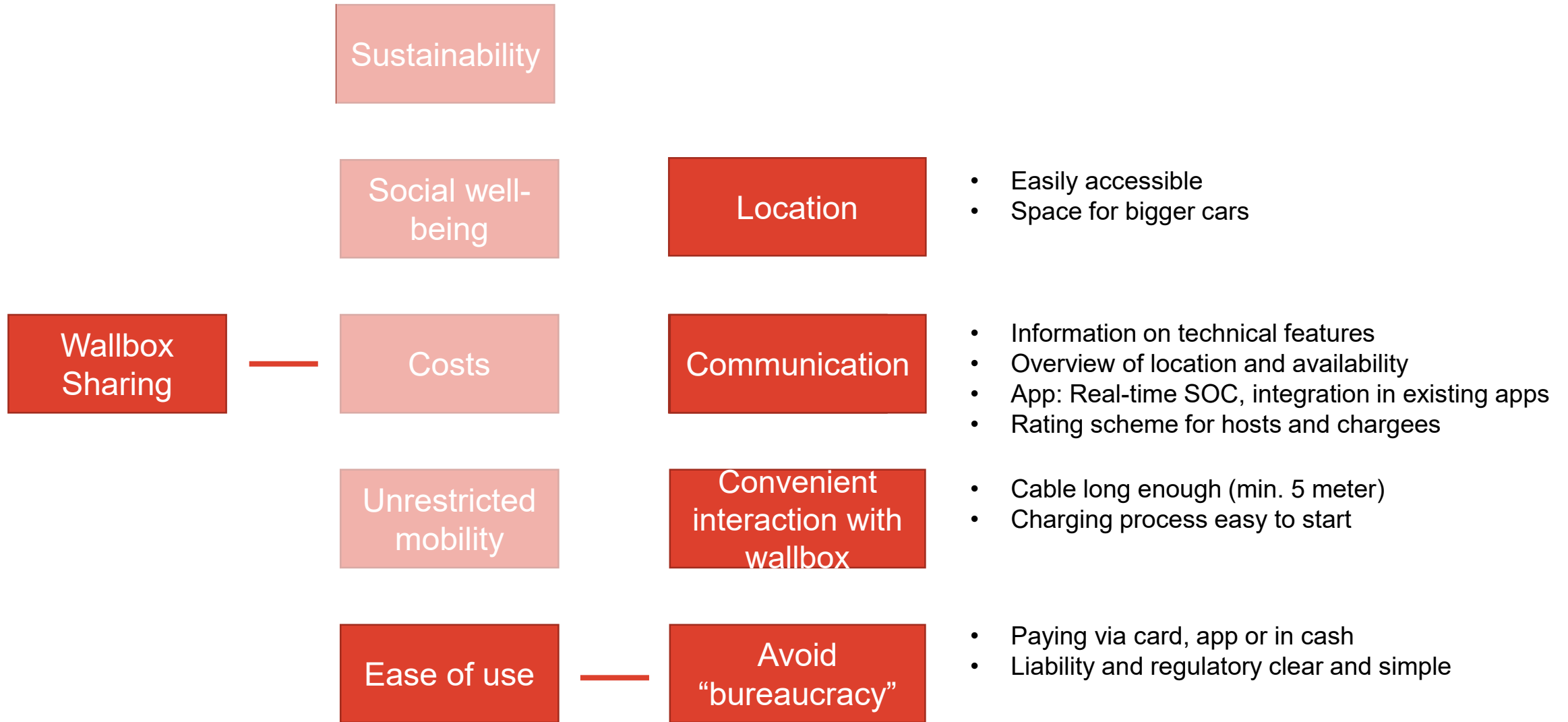
Objective system (chargees) – Costs



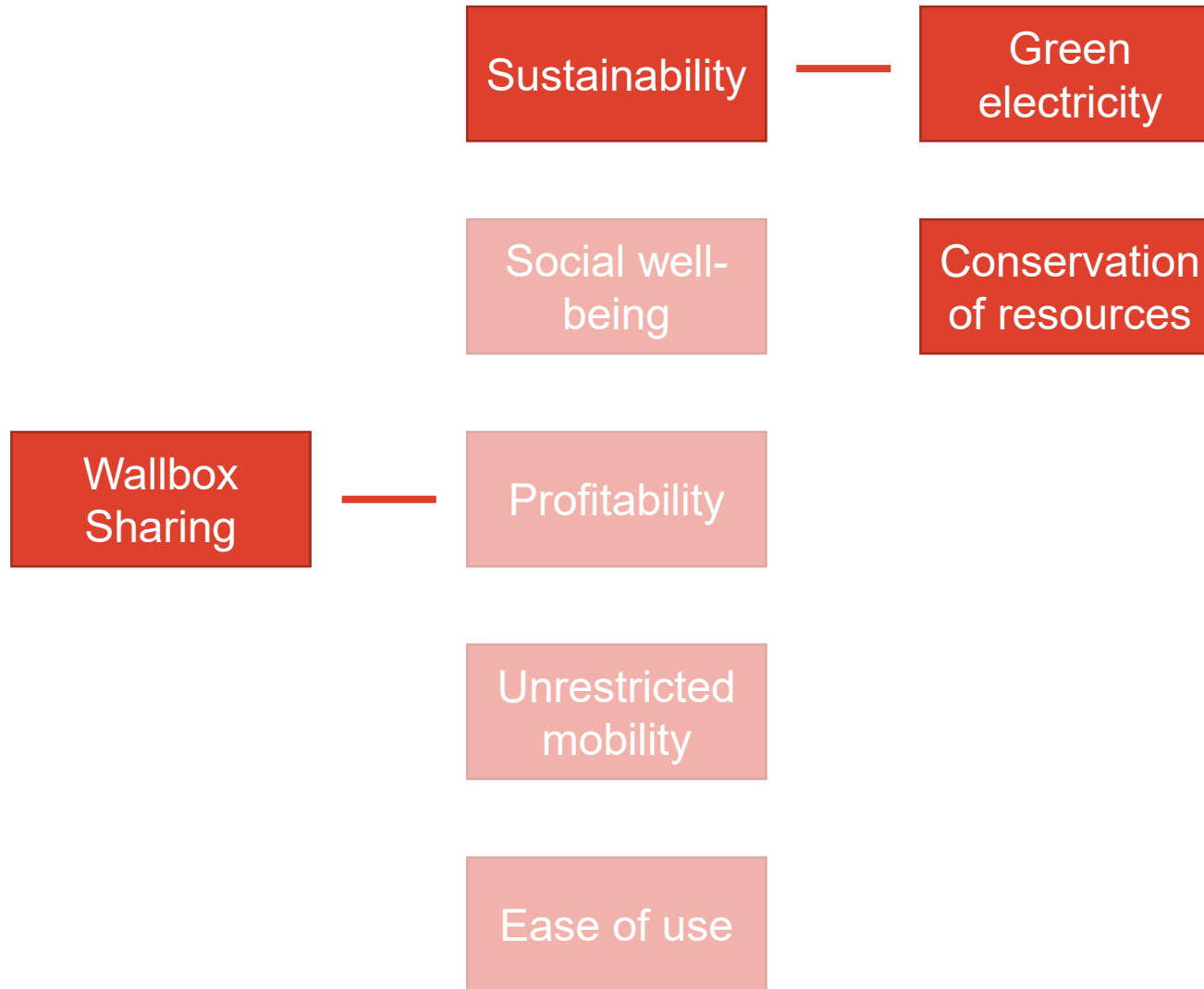
Objective system (chargees) – Unrestricted mobility



Objective system (chargees) – Ease of use

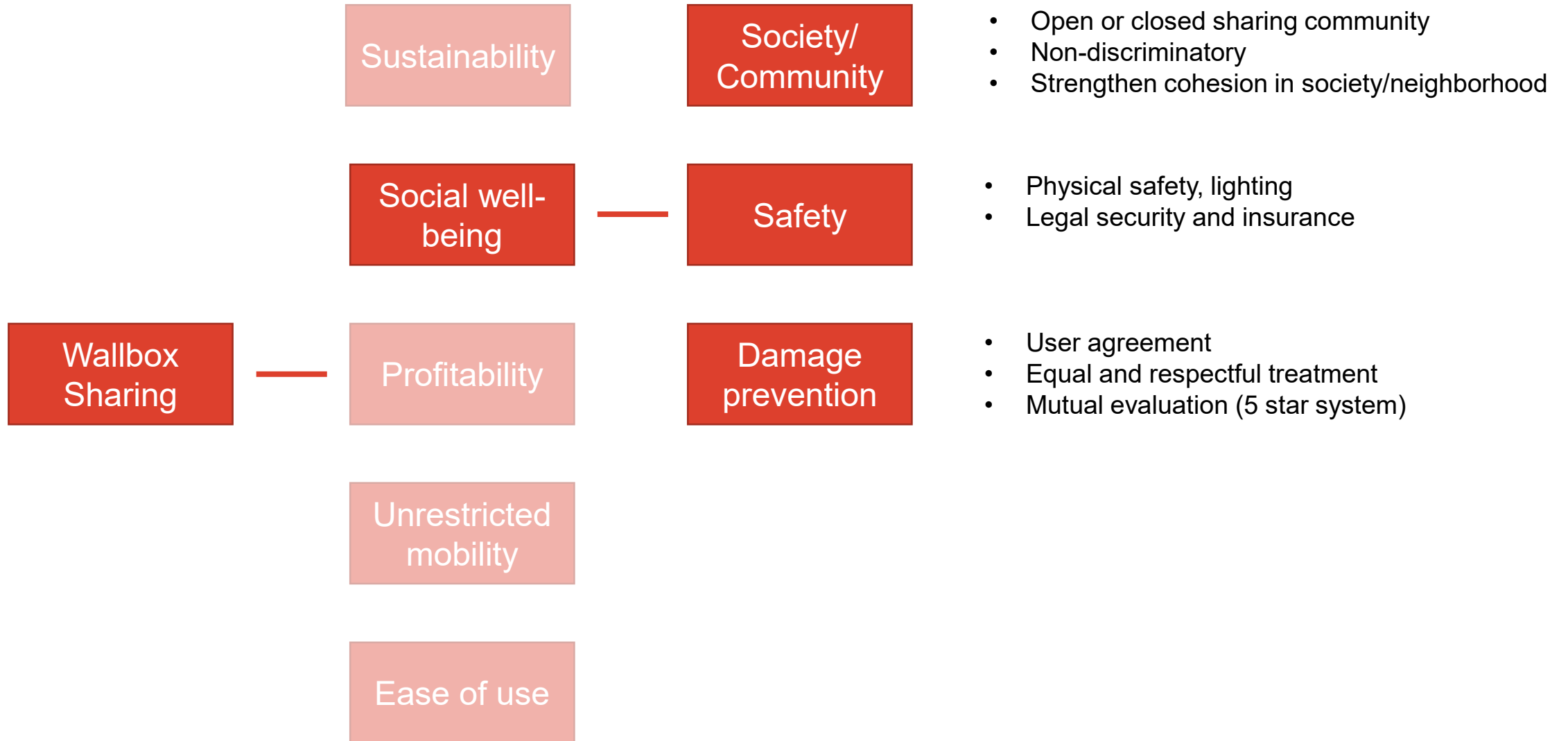


Objective system (hosts) - Sustainability

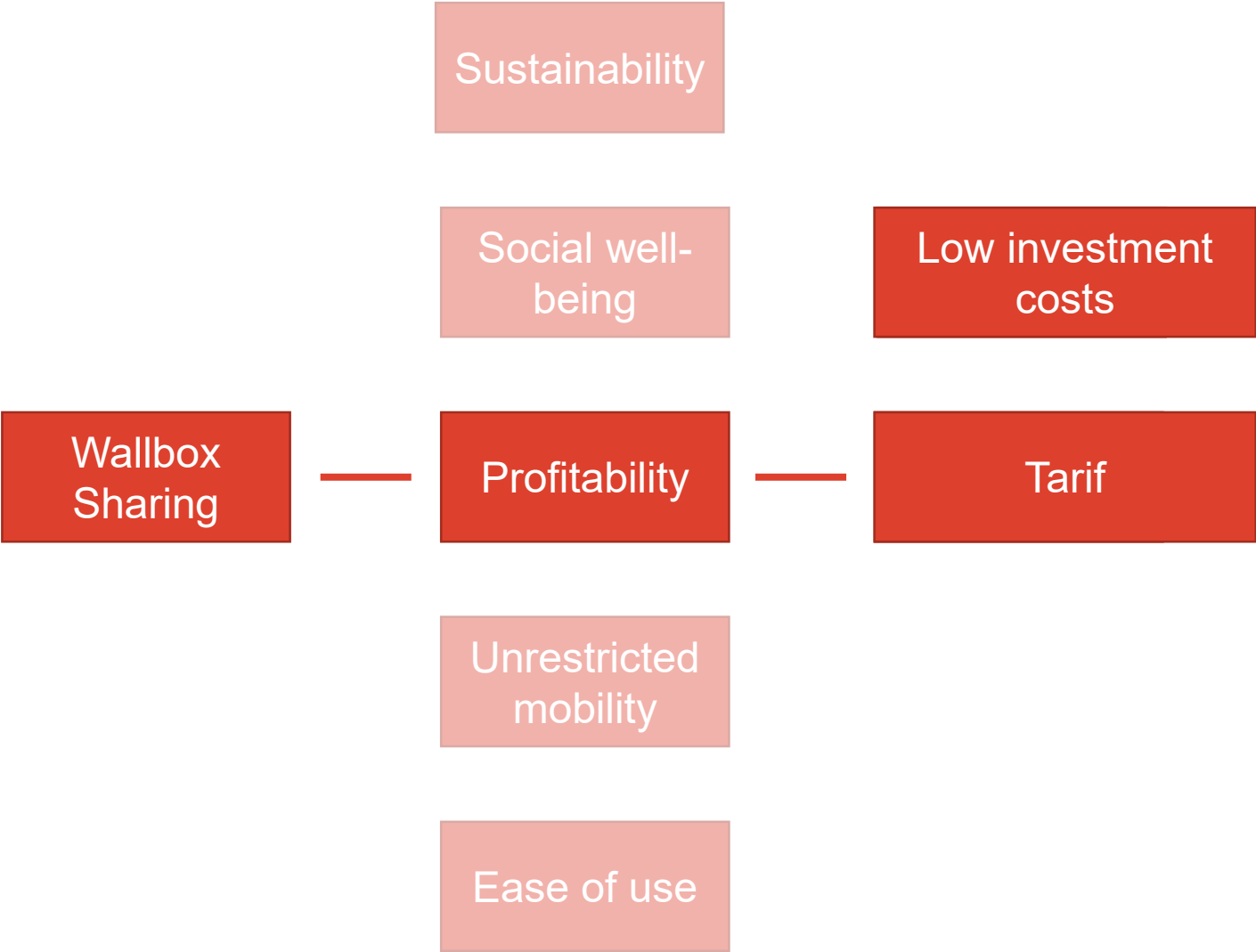


- Pricing according to green electricity share/production
- Managing load to maximize green (PV) electricity utilization
- Increase utilization of wallbox

Objective system (hosts) – Social Well-being

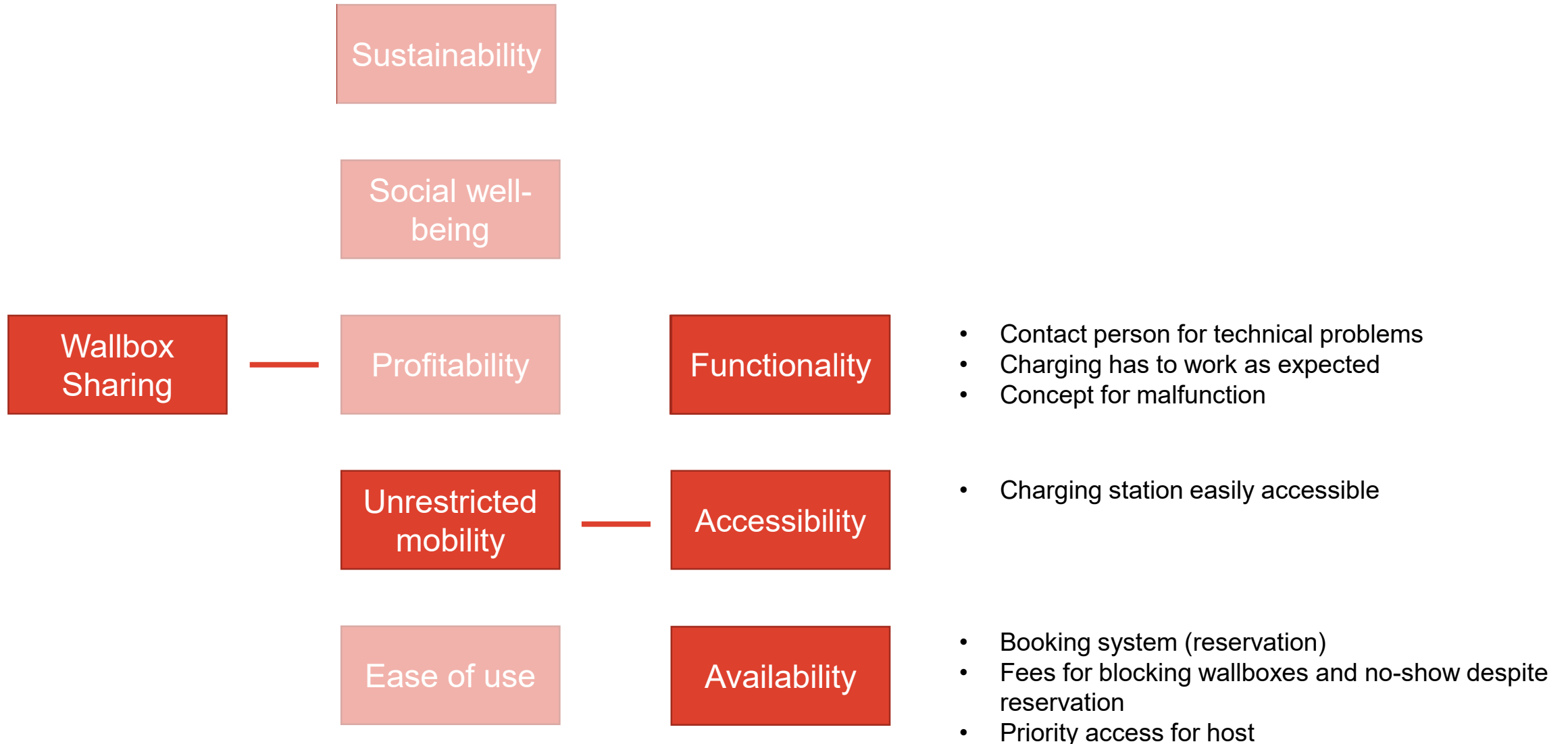


Objective system (hosts) – Profitability

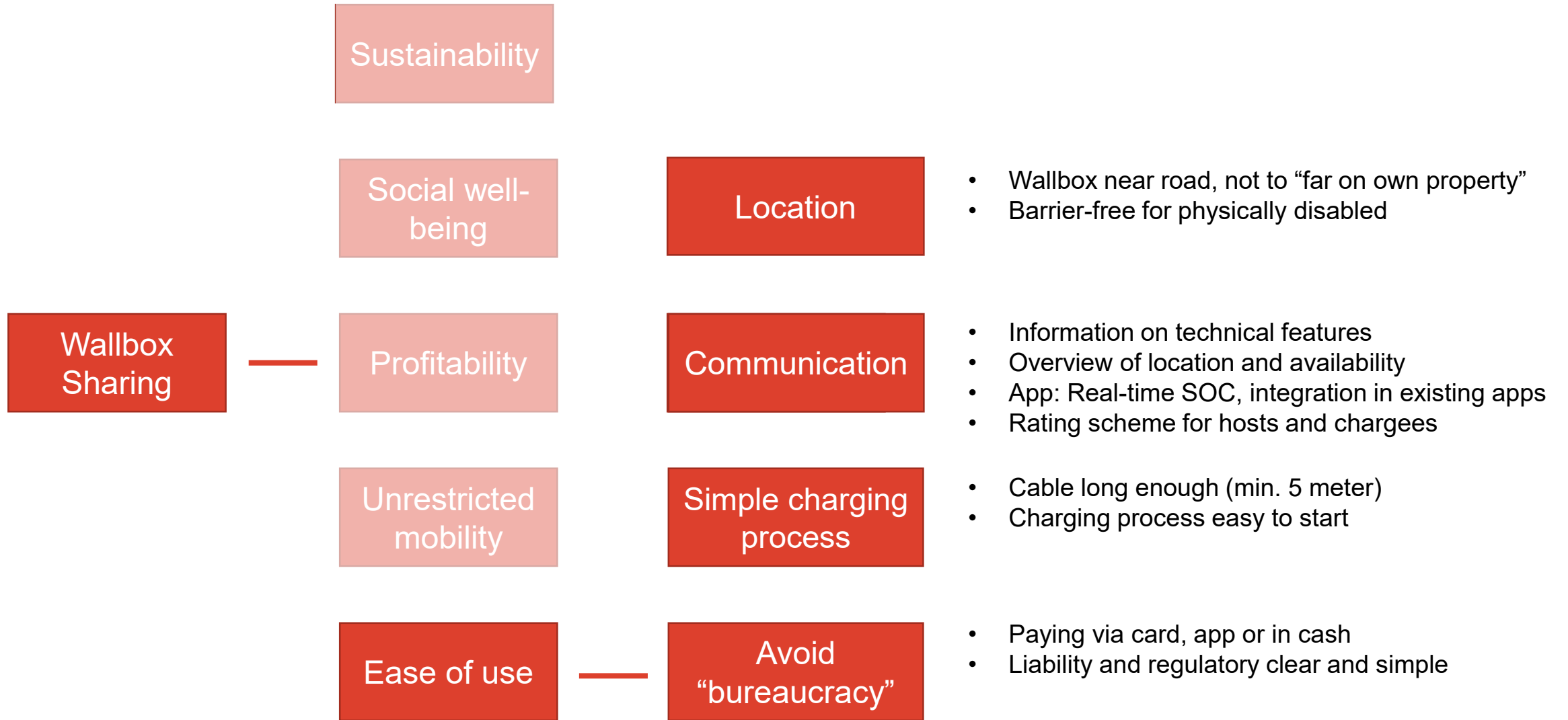


- Reasonable prices or even bartering
- Time-of-use tariffs (flexible pricing)
- Financial compensation for making wallbox accessible for public (cost-covering + x)






Objective system (hosts) – Unrestricted mobility



Objective system (hosts) – Ease of use



Two Alternatives Conceivable

		Supraregional alternative	Regional alternative
	Contact	Online-platform (incl. app)	User permission granted by personal invitation
	Start of charging	Activated via app	Activated via chip card or wallbox owner
	Time slots	Displayed via online platform and booked by users	<ul style="list-style-type: none"> • Fixed charging times are agreed • Wallbox owner is responsible for the scheduling
	Payment	<ul style="list-style-type: none"> • Service provider responsible for processing booking • Digital payment method per charging process 	Payment monthly in cash or digitally.
	Pricing	Between electricity generation/purchase costs and costs of public charging stations	
		Costs comparatively high	Costs comparatively low

Hypothesis

1. Social well-being is more important to female EV drivers without their own wallbox than to male EV drivers
2. Ü60, the unlimited mobility is secondary
3. The financial aspects are not essential for wallbox owners
4. From the point of view of all criteria, there is a need for regulation