Case study: Urban sustainability assessment

13th EURO PhD Summer School on MCDA/MCDM

Chania, Greece

Case study group #2

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Agenda

1. Characterisation of the decision situation
2. Model selection and implementation
3. Results and discussion
4. Conclusions

WHAT
THIS
IS ALL
ABOUT

The decision aiding context

- OPA! is the owner of a Greek **real estate** investment trust
- **Expansion** of their portfolio for further growth
- Allocation of investments to real estate in **multiple cities** for risk diversification
- **Long-term prospects** of the cities are important for successful investments

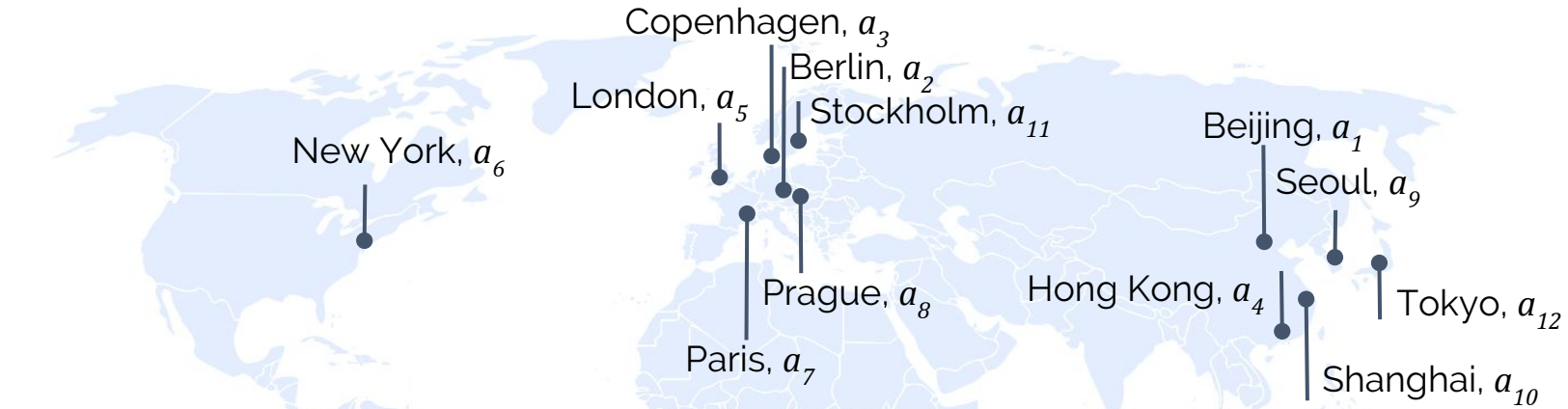
OPA!

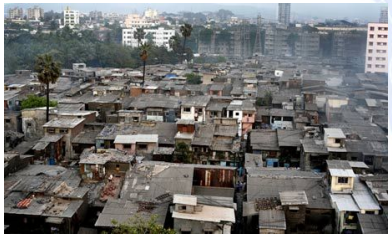
Develop a tool to evaluate cities according to their sustainability level fitting the decision-maker's preference information.

Actors

Decision-maker	Analysts	Expert
Managing director of OPA!	Chania Research Group	Internationally recognized polish specialist

Cities under assessment



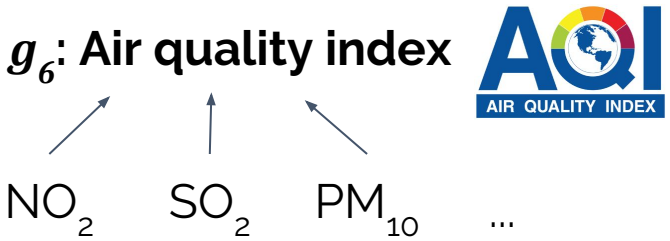


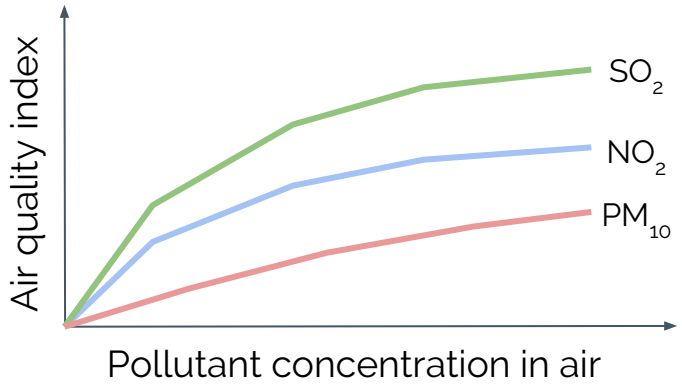
HOW CAN WE MODEL IT?

Consistent family of criteria

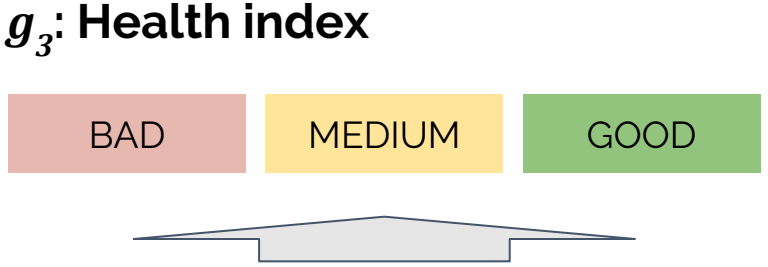
Aggregation of sustainability indicators to criteria

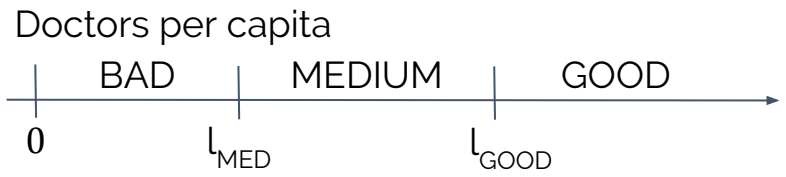
Example 1
Computation of an aggregate index

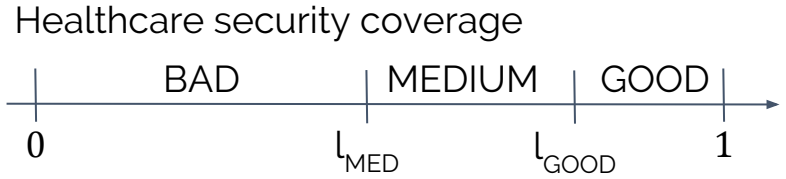




Example 2
Aggregation using ordinal scales



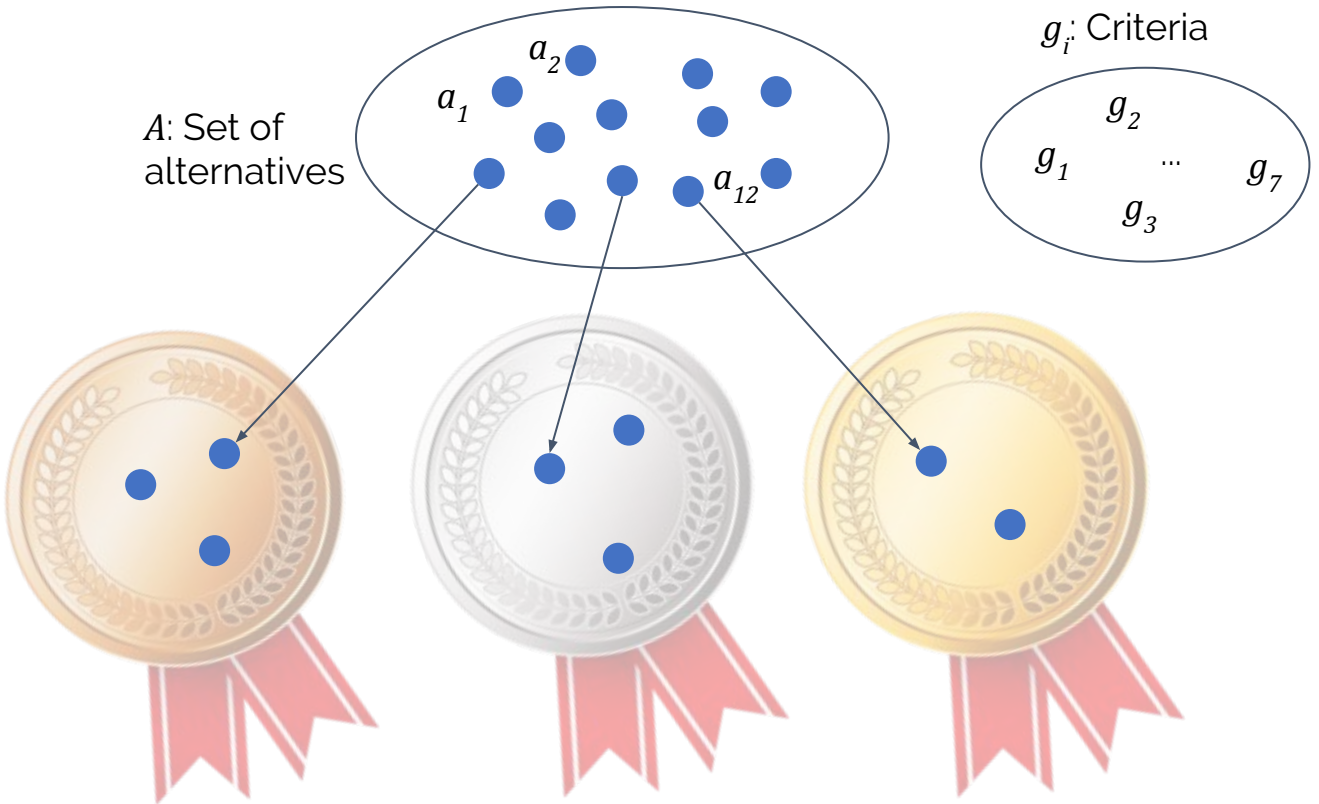




Cheng et al. (2007)

Type of decision problem

P_β - Sorting of alternatives (cities) into pre-defined ordered classes



C_i: Ordered classes C_1: BRONZE $\prec$ C_2: SILVER $\prec$ C_3: GOLD

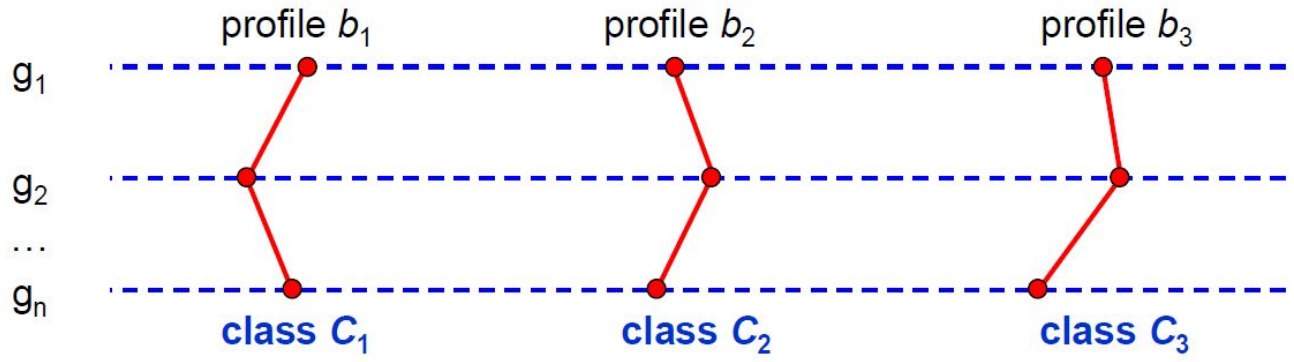
Choice of an appropriate method

Possible approaches to sorting problems

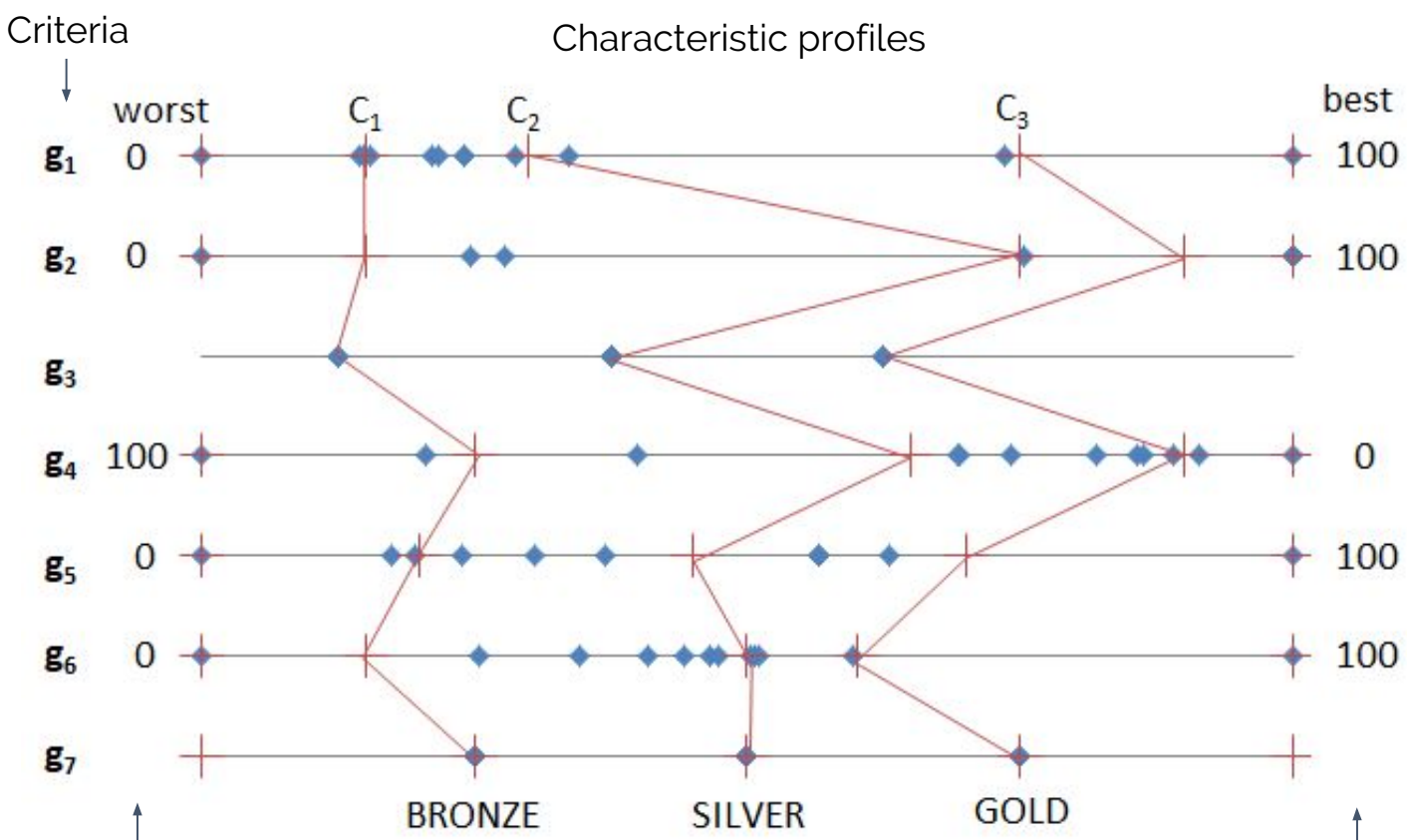
- Value-based, *e.g.* UTADIS
- Outranking, *e.g.* ELECTRE TRI
- Rule-based, *e.g.* Dominance-based Rough Set Approach (DRSA)

Proposed method: ELECTRE TRI-C

- Characteristic profiles to describe representative criteria values



Categories and thresholds



Thresholds

q_i	p_i	v_i
1	10	50
1	5	10
0	1	-
3	10	80
2	7	-
2	10	-
0	1	-

q_i Indifference
p_i Preference
v_i Veto

Normalized scales: $g'_{ij} = \left(\frac{g_{ij} - g_{i*}}{g_i^* - g_{i*}}\right) * 100$

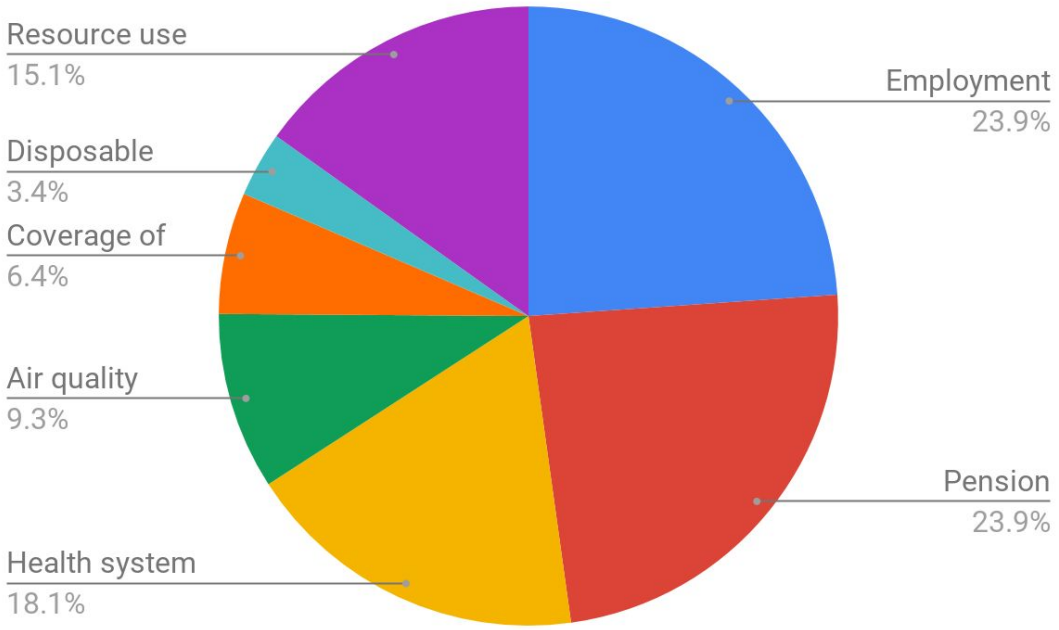
*DRUM
ROLL
INTEN-
SIFIES*

Simos' revised procedure

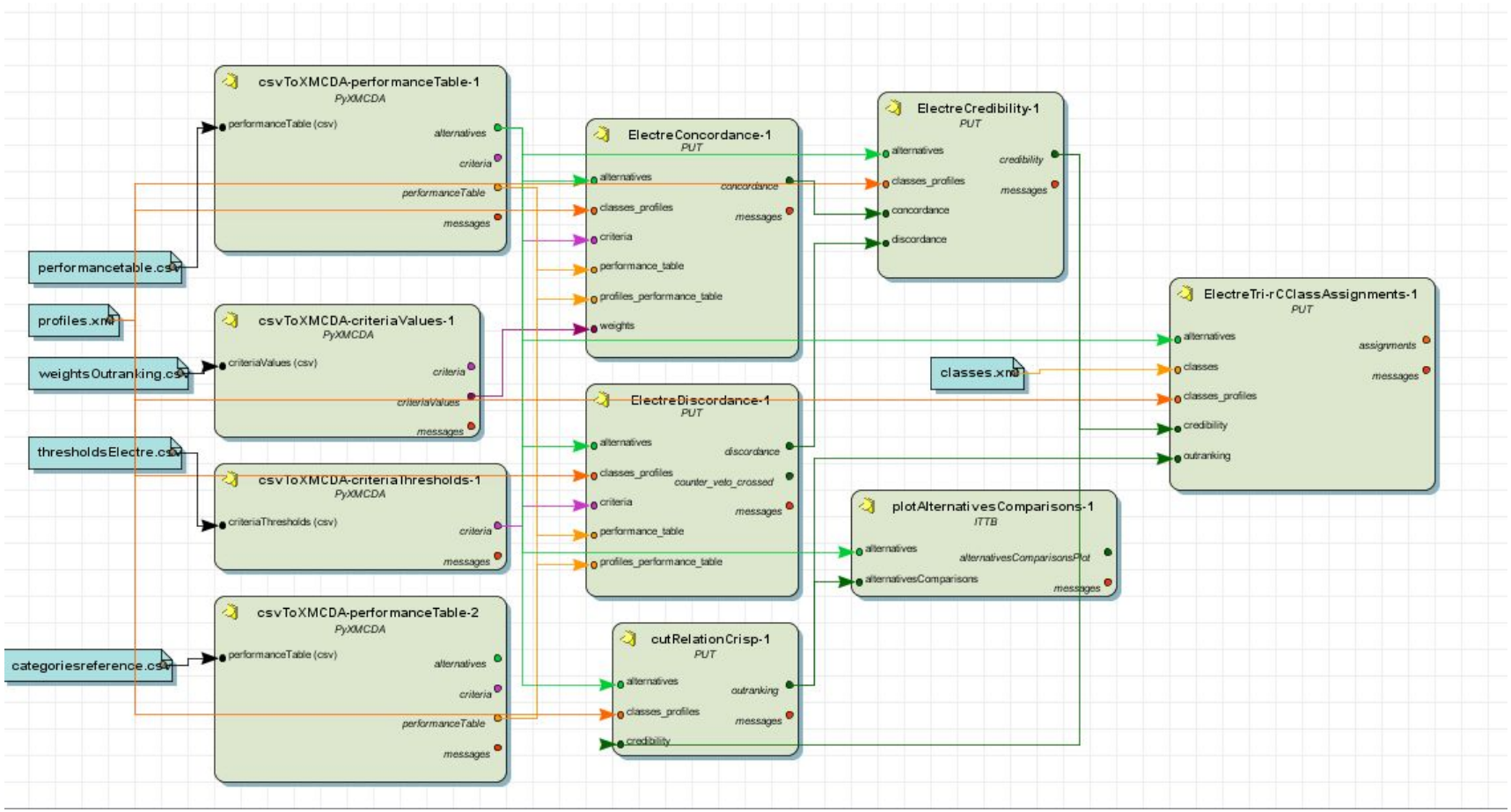
Ranks and blank cards	
R_1	*Employment, Overall economical state*
e_1	2
R_2	*Healthcare services' availability*
e_2	0
R_3	*Natural resources' dependence*
e_3	0
R_4	*Retirement endurance*
e_4	0
R_5	*Urban green-friendliness*
e_5	0
R_6	*Pollution*
Ratio-*z*	7

Weights

Criteria	Weights
g_1	*0.2390*
g_2	*0.2390*
g_3	*0.1806*
g_4	*0.0925*
g_5	*0.0635*
g_6	*0.0341*
g_7	*0.1513*
TOTAL	***1***



Model implementation in diviz



Categorisation

BRONZE

- Beijing
- Prague
- Shanghai

SILVER

- Berlin
- Copenhagen
- Hong Kong
- Seoul
- Stockholm
- Tokyo

GOLD

- London
- New York
- Paris

WHAT
CAN WE
WITHDRAW
FROM
THIS?

Conclusions

- ELECTRE TRI-C was a suitable approach to tackle this case.
- Other methods (*e.g.* UTADIS and DRSA) and criteria could have been used to solve the problem.
- London, New York, and Paris are the most sustainable cities from the set.
- Opa!'s real estate investment trust should invest more in immovables in these locations.

Thank you, guys!

And thank you, Chania!