

# Tools & methods for e-mobility

## Impact assessment: An overview

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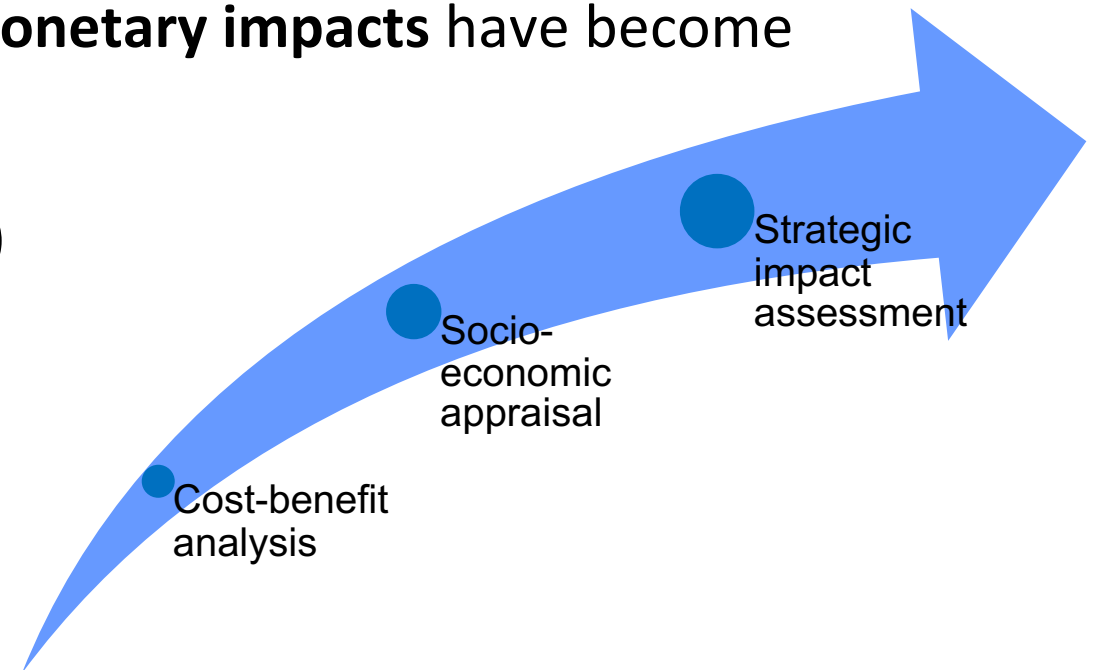
# Today's agenda

- The basics of Multi-Criteria Decision Analysis (MCDA)
- Decision trees
- Eliciting scores
- Eliciting weights
- Score/weight aggregation
- Today's status and future steps
- Discussion



# Project appraisal

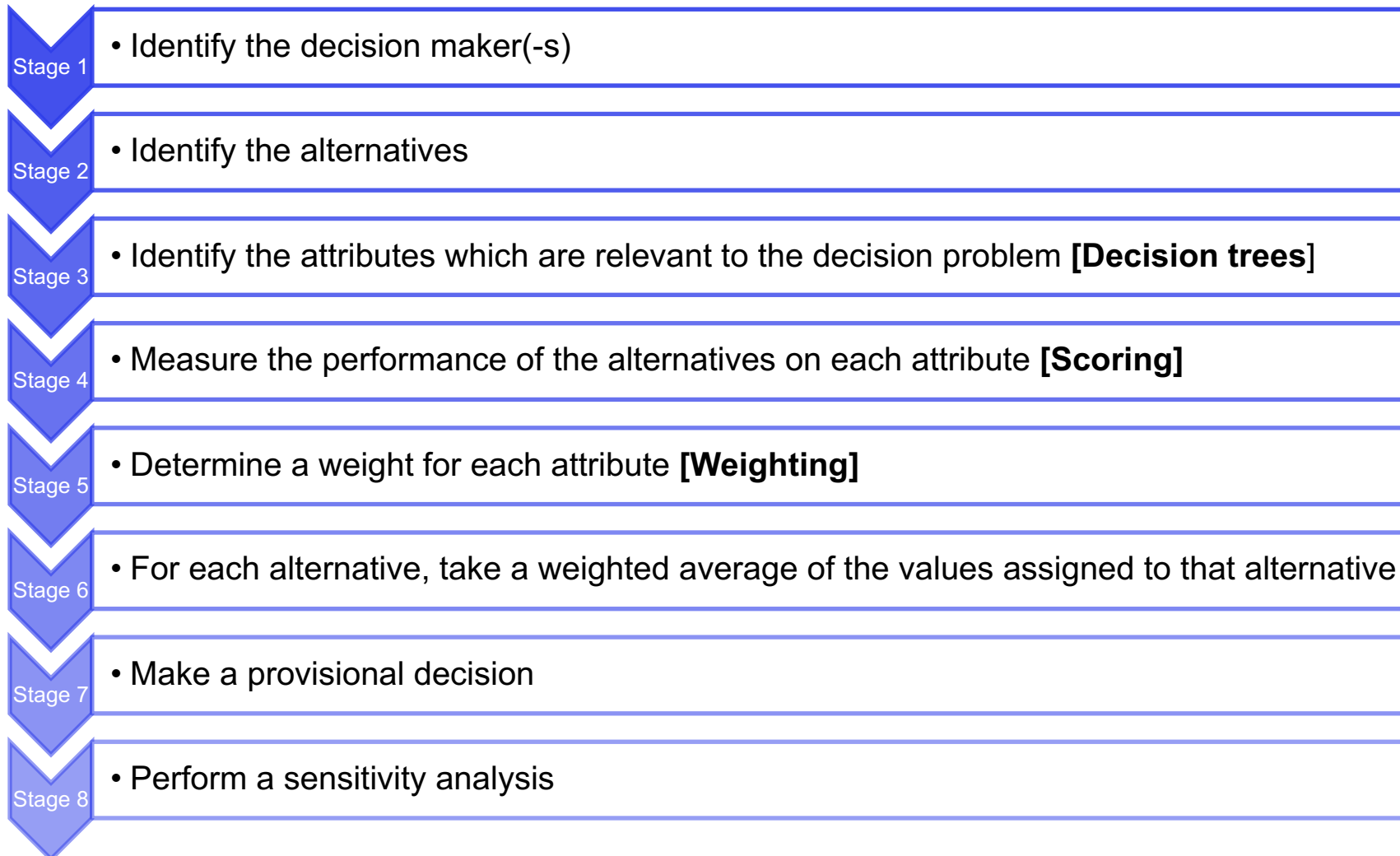
- Traditional project evaluations are limited to **socio-economic appraisals** using **cost-benefit analysis (CBA)**
  - Provide decision-makers with a **monetary assessment** of a initiative/project/alternative
  
- Greater considerations with regard to **non-monetary impacts** have become necessary
  - **Strategic Impact Assessment**
  - Multi-Criteria Decision Analysis (MCDA)

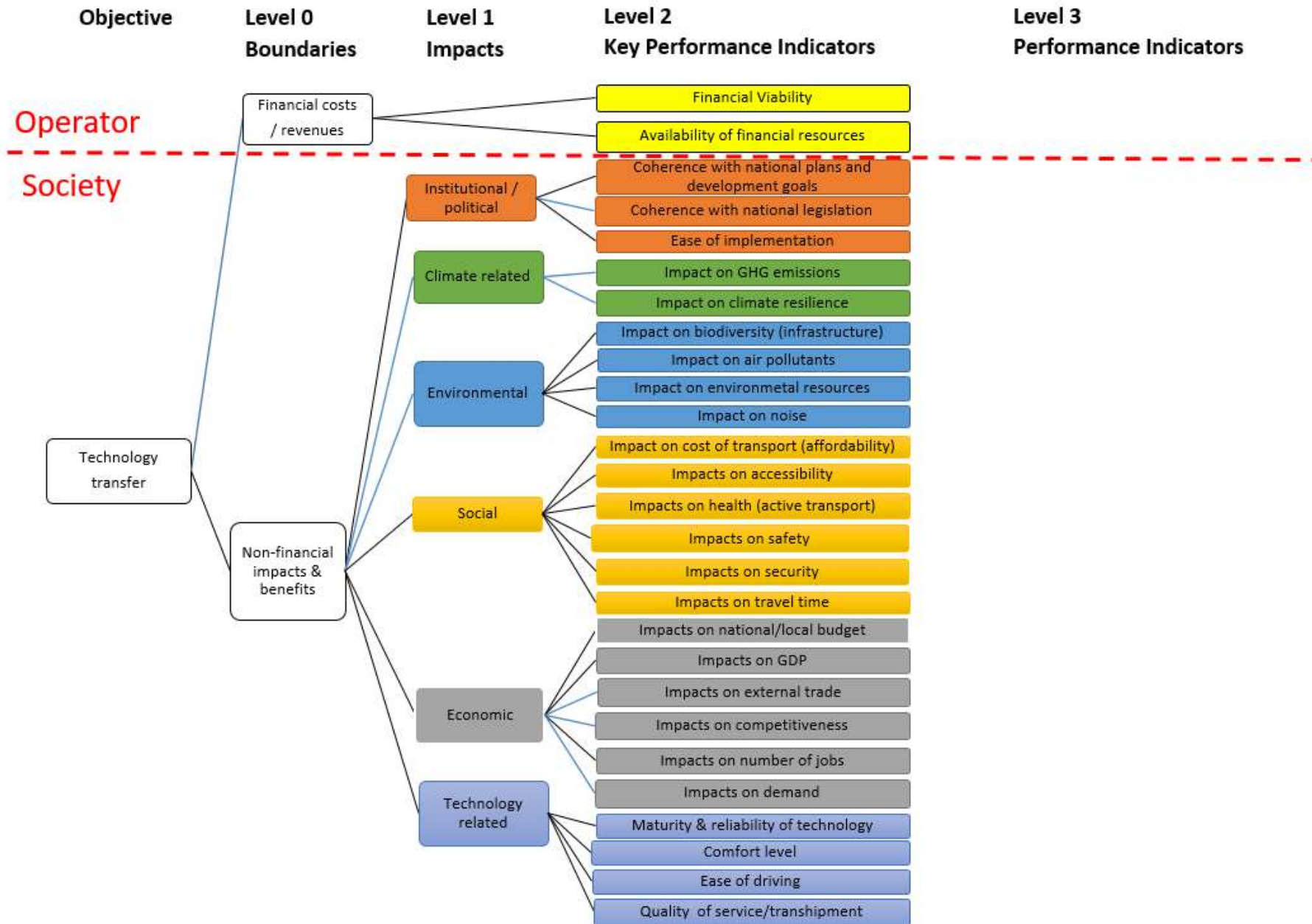


# MCDA in the public sector

- An important **supplement** to CBA
- Takes into account and synthesizes several effects (both quantitative and qualitative)
- Takes into account and synthesizes the views of all stakeholders
- MCDA does NOT:
  - give the “right” answer
  - provide an “objective” analysis that relieves decision makers of having to make difficult judgements
  - take the pain out of decision making
- However, MCDA **has the potential** of improving decision making

# The Simple Multi-Attribute Rating Technique - SMART





Our decision tree (draft)

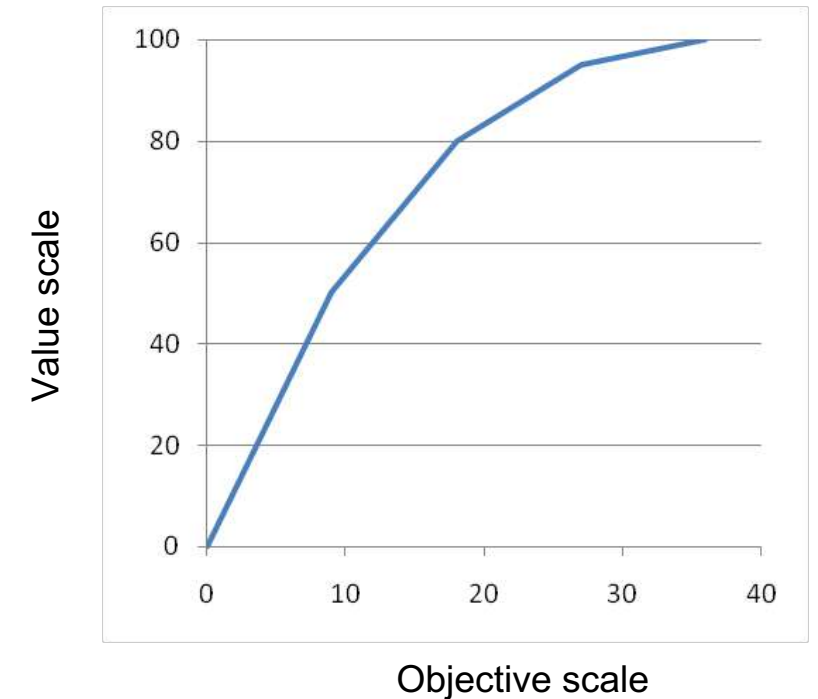


# Eliciting scores

- The process of assessing a value derived from the performance of alternatives against the relevant criteria
- Scores can be elicited in one of the following ways:
  - **Partial value function** (measurable attributes)
  - **Qualitative value scale** (reference to descriptive points)
  - **Direct rating** of the alternatives (the decision-maker specifies a number/point which reflects the value of an alternative)

# Scoring Method 1: Partial value function

- The **bisection** method
  - Identify the two endpoints
  - Consider the midpoint on the objective scale and determine which of the two half increases is the most valuable
  - Find the midpoints between the two endpoints and the previous found midpoint
  
- 5 points (2 endpoints and 3 midpoints) provides sufficient information to sketch in the value function


















# Scoring Method 2: Qualitative value scale

- When not possible to find a measurable attribute that captures a criterion
  - Construct an appropriate qualitative scale
  - Define at least two points on the scale (often taken as the end points)
- Points on the scale are defined descriptively and draw on multiple concepts in the definition

# Beaufort Scale

## Scoring Method 2: Qualitative value scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

# Scoring Method 3: Direct rating

- The decision maker constructs a value scale
  - Defines the end points of the scale
  - Positions all alternatives directly on the scale to reflect their performance relative to the two end points
  
- The scale can be local or global
  - **Local:** defined only with relation to the alternatives being assessed
  - **Global:** defined with relation to a wider set of possibilities

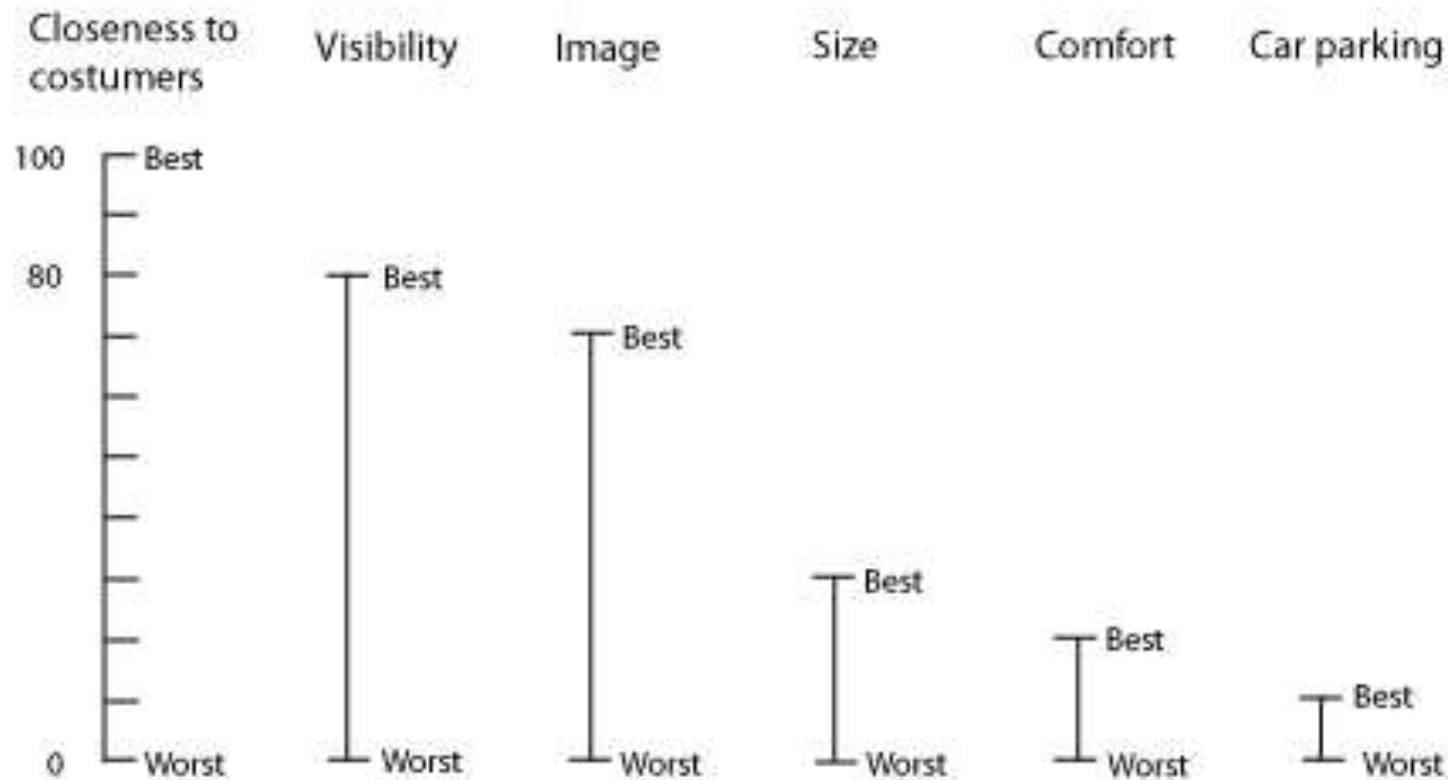
# Eliciting weights (3 steps)

- Step 1. Rank the criteria according to importance

Rank	Criteria
1	Closeness to costumers
2	Visibility
3	Image
4	Size
5	Comfort
6	Car-parking facilities

# Eliciting weights (3 steps)

- Step 2. Estimate swing weights



# Eliciting weights (3 steps)

➤ Step 3. Normalize swing weights

Attribute	Original weights	Normalized weights
Closeness	100	32
Visibility	80	26
Image	70	23
Size	30	10
Comfort	20	6
Parking	10	3
	310	100

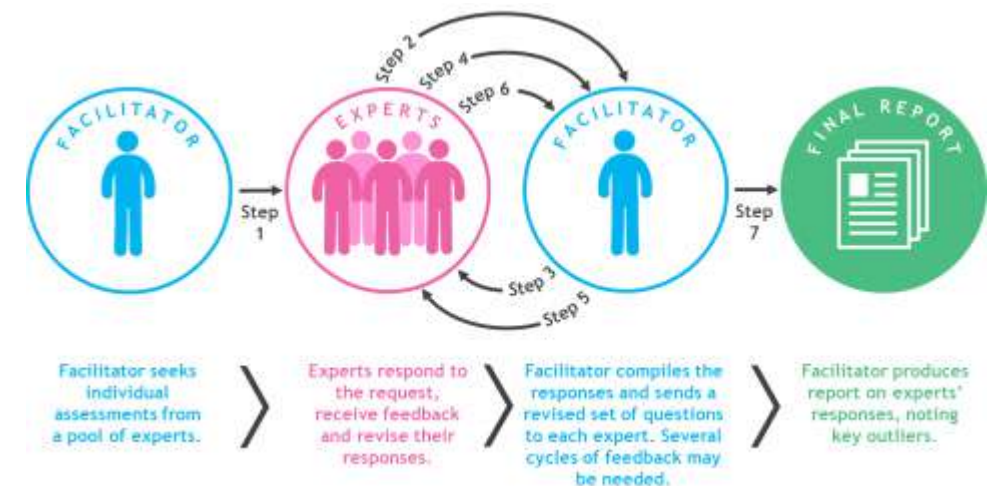
# SMARTER – Variation of SMART

- SMART Exploiting Ranks
- Simplified decision process
- Converts criteria rankings into weights using e.g. the Rank Order Distribution (ROD)

Rank	2	3	4	5	6	7	8
1	0.6932	0.5232	0.4180	0.3471	0.2966	0.2590	0.2292
2	0.3068	0.3240	0.2986	0.2686	0.2410	0.2174	0.1977
3		0.1528	0.1912	0.1955	0.1884	0.1781	0.1672
4			0.0922	0.1269	0.1387	0.1406	0.1375
5				0.0619	0.0908	0.1038	0.1084
6					0.0445	0.0679	0.0805
7						0.0334	0.0531
8							0.0263

# Behavioral aggregation – Delphi method

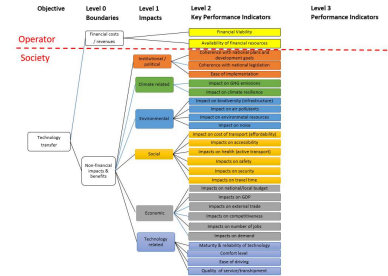
1. Panelists provide estimates anonymously (often through a questionnaire)
2. Results of this polling are tallied and statistics of group's opinions are fed back to panelists
3. A re-polling takes place, during which anonymous discussion may occur (usually in written form) so that dissenting opinions are aired
4. Process is repeated until a consensus emerges or no further changes of opinion are evident
5. Median of the group's estimate in the final round is then used as their estimate





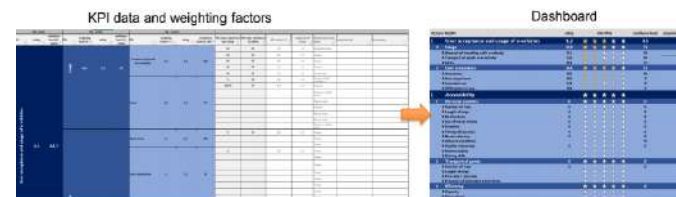
# Where do we stand today?

- Have a draft structure of criteria (KPIs & PIs)
- Have a draft list of input indicators for each city/component
- Have developed the evaluation tool



Area	Indicator	Unit	Scale	Weight	Direction	Availability
Operator	Financial cost	€	1000000	1	↓	✓
	Energy consumption	kWh	1000000	1	↓	✓
	CO2 emissions	kg	1000000	1	↓	✓
	Water consumption	m³	1000000	1	↓	✓
	Waste production	kg	1000000	1	↓	✓
	Occupancy rate	%	100	1	↑	✓
	Customer satisfaction	1-5	100	1	↑	✓
	Service reliability	%	100	1	↑	✓
	Energy efficiency	kWh/km	1000000	1	↓	✓
	CO2 emissions per km	kg/km	1000000	1	↓	✓
Society	Energy consumption	kWh	1000000	1	↓	✓
	CO2 emissions	kg	1000000	1	↓	✓
	Water consumption	m³	1000000	1	↓	✓
	Waste production	kg	1000000	1	↓	✓
	Occupancy rate	%	100	1	↑	✓
	Customer satisfaction	1-5	100	1	↑	✓
	Service reliability	%	100	1	↑	✓
	Energy efficiency	kWh/km	1000000	1	↓	✓
	CO2 emissions per km	kg/km	1000000	1	↓	✓
	Vehicle kilometers traveled	km	1000000	1	↓	✓

## EVALUATION FRAMEWORK – TOOL LAY-OUT



# What comes next?



- Assessment methodology (scaled-up project)
  - Finalize criteria structure (KPIs & PIs)
  - Elicit stakeholder weights and aggregate them
  - Finalize input indicators for each city/component
  - Update evaluation tool
- Description of baseline scenario
- Demo assessments
  - Ex ante assessment
  - Ex post assessment



Thank you for  
your attention !

Questions ?

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