

Session

Cities 2: Net Zero Cities & Neighborhoods

Thursday, 12 September 2019

Crafting local climate action plans:

An action prioritization framework using multiple criteria decision analysis

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First, some numbers...

■ Global Covenant of Mayors (GCoM):

Number of cities with ...

- A commitment 9209
- Mitigation target 8413
- Mitigation inventory 5396
- Mitigation plan 5286
- Compliance 104

Vast gaps

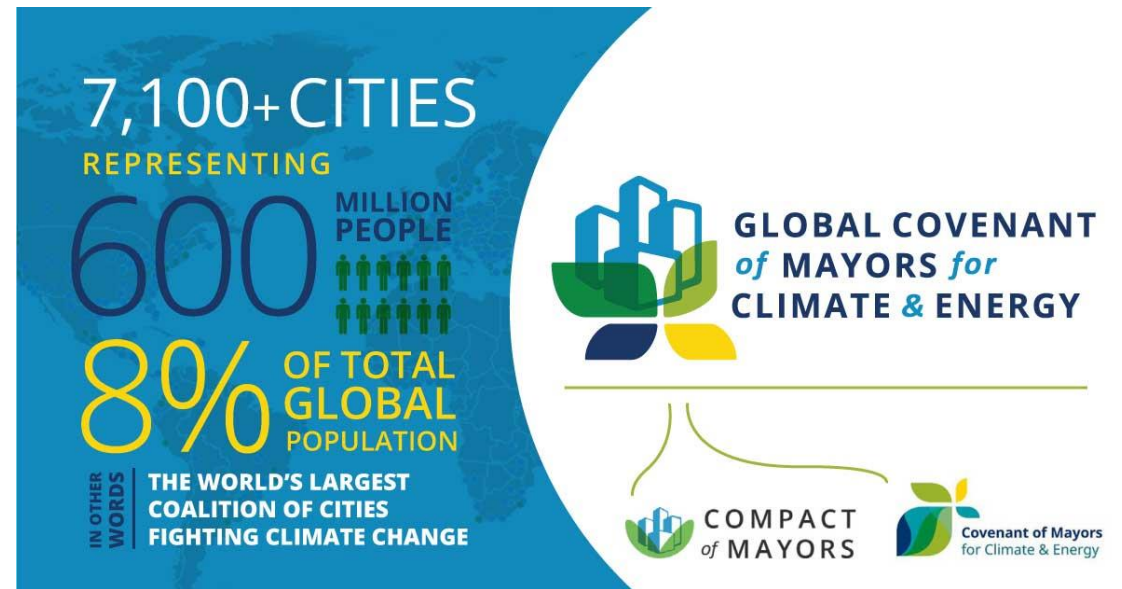
Data Source: www.globalcovenantofmayors.org/our-cities/

■ EU Covenant of Mayors (EU CoM):

Number of cities with ...

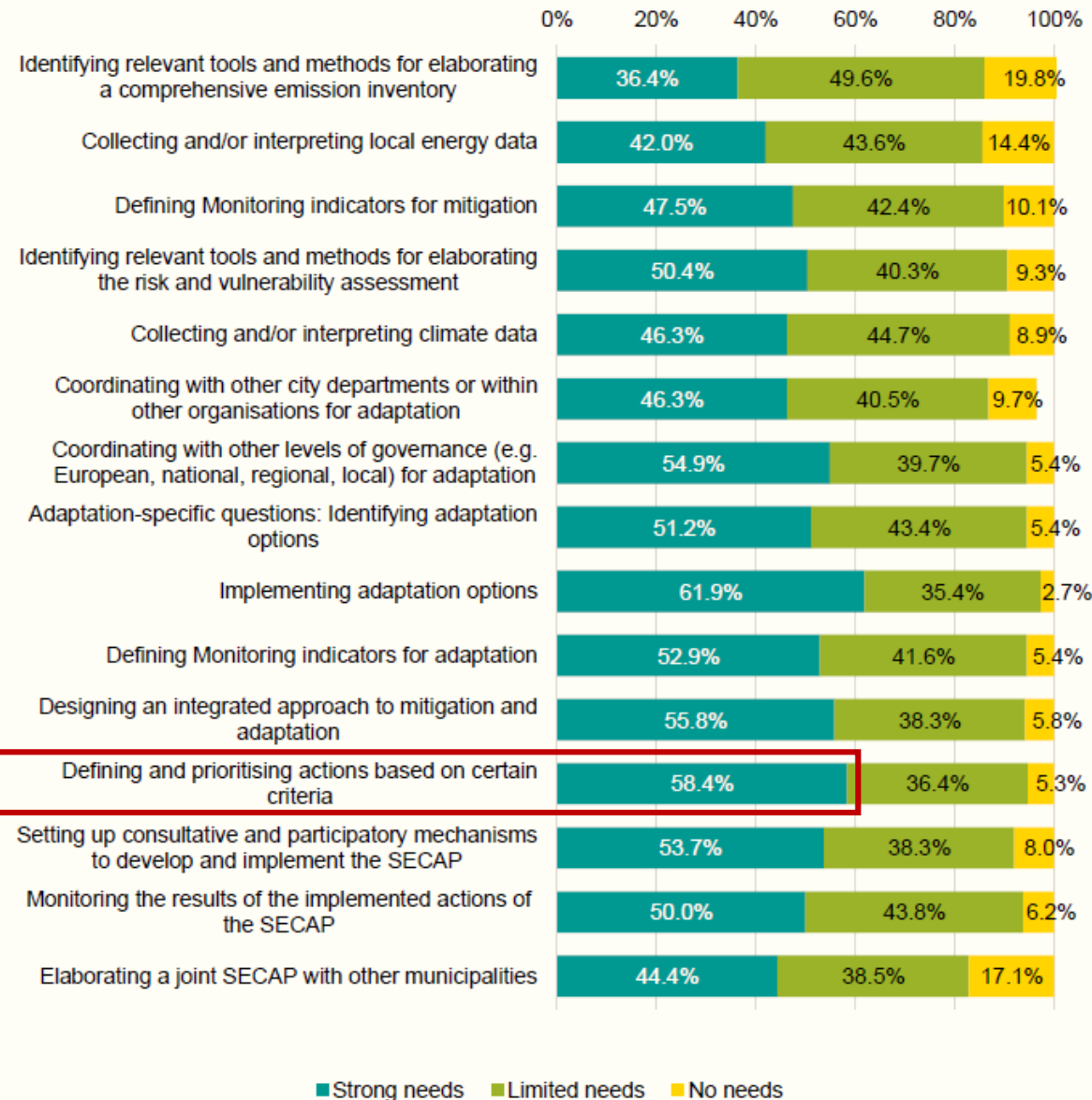
- Action plans (in general) 4190 *≈ 2/3 of EU CAPs will soon expire*
- Action plans 2030 1555

Data Source: www.covenantofmayors.eu/plans-and-actions/action-plans.html



Source: https://www.c40.org/blog_posts/eu-covenant-of-mayors-and-compact-of-mayors-launch-largest-global-coalition-of-cities-committed-to-fighting-climate-change

Municipalities' needs: methodologies for climate and energy planning



First, some numbers (continued)...

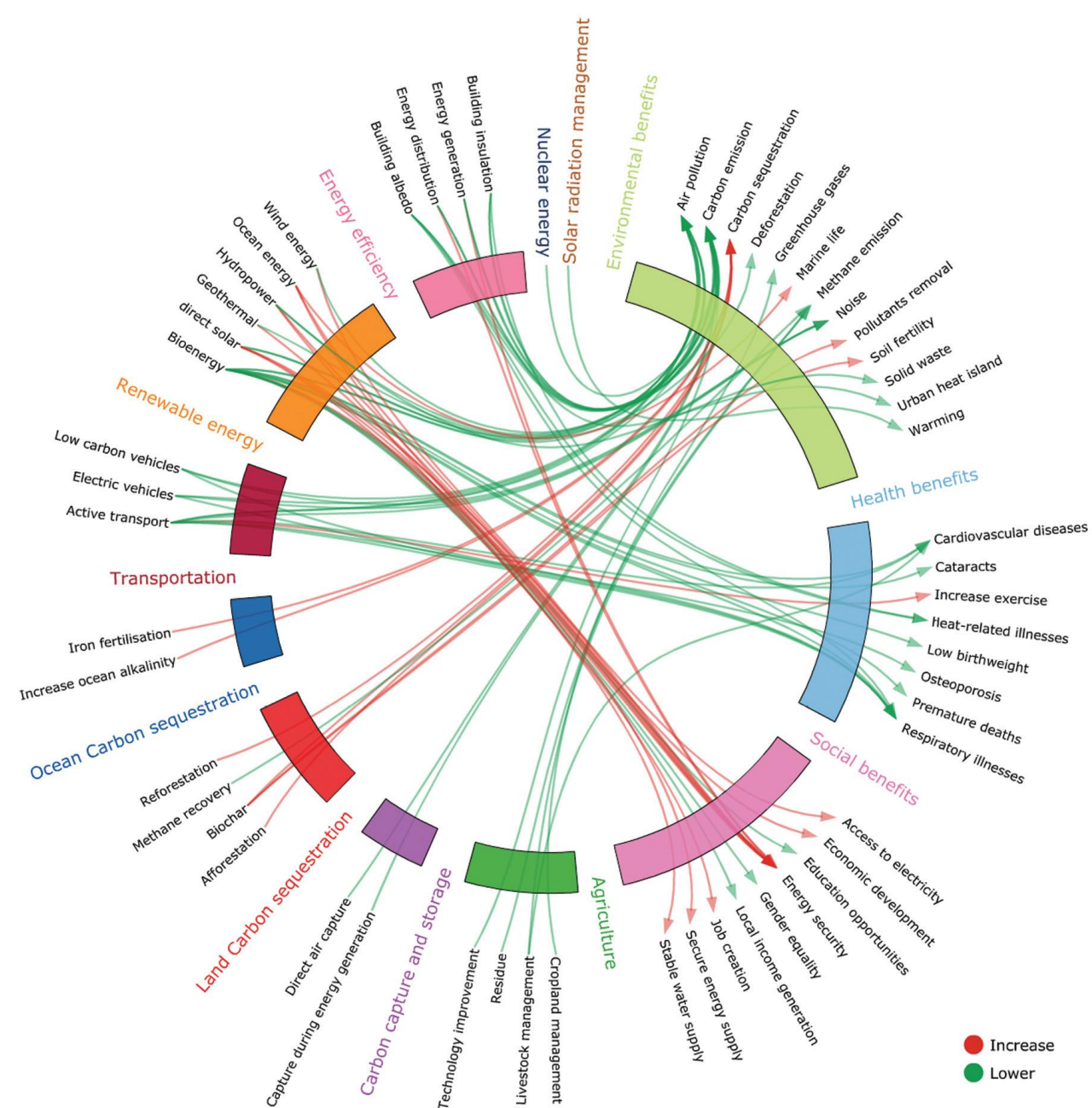
- **Left side:** 2017 survey by the EU CoM Office on their community's *capacity-building needs and knowledge gaps* for the design and implementation of Sustainable Energy and Climate Action Plans (SECAPs)
- **2nd strongest methodological need of EU municipalities:** defining and prioritising actions based on certain criteria

The challenge

To identify and prioritise actions that can satisfy a reduction target as close to zero as possible while balancing in parallel:

- (1) (Often) conflicting and incommensurable environmental, economic, social and technical aspects
- (2) Conflicting stakeholder interests

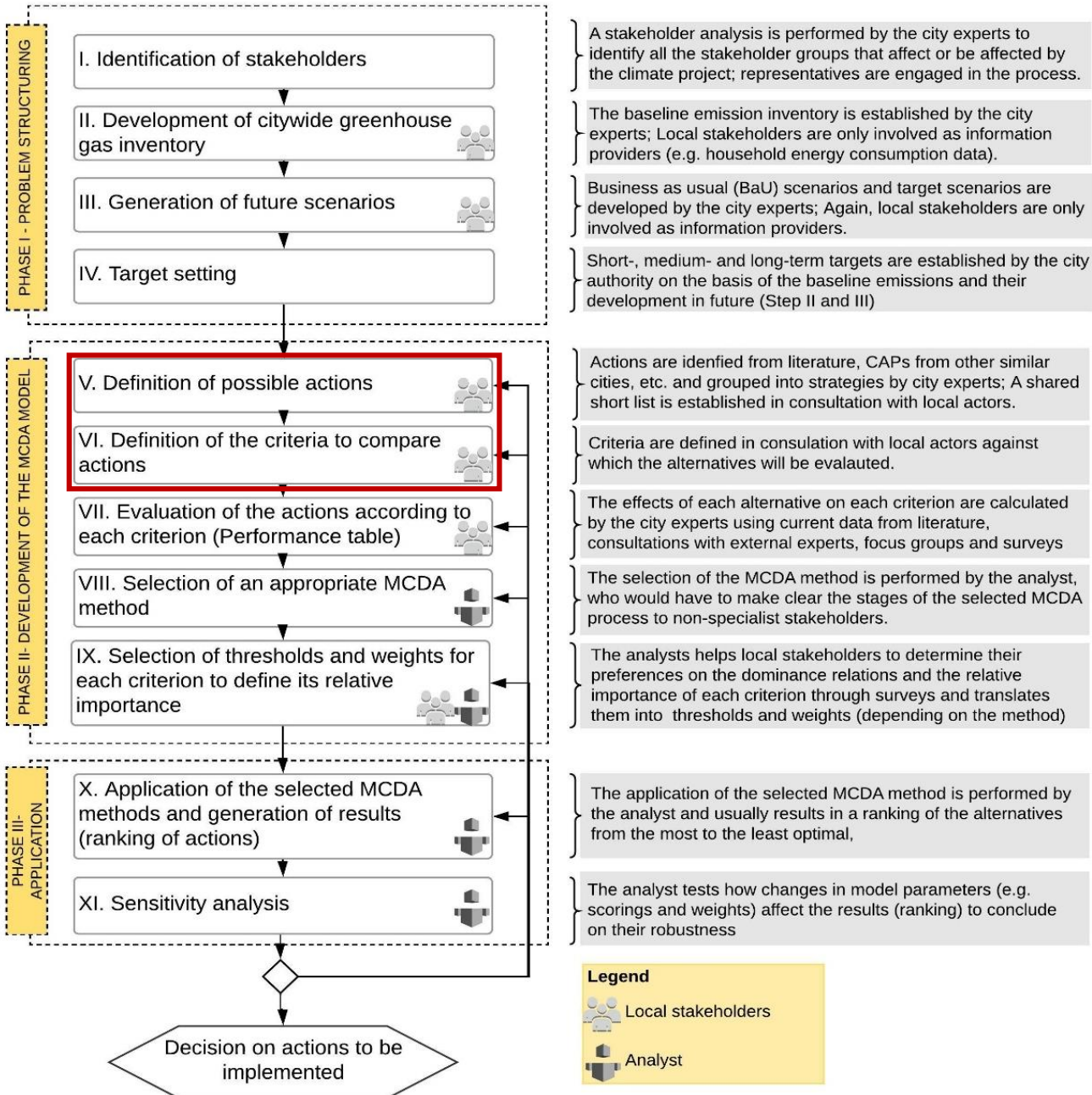
Bottom line: Cities are faced with a multi-criteria and intricate problem...



Source of illustration : Sustainability Solutions Group (2017). Modelling Toronto's Low Carbon Future. Considerations of Co-benefits and Co-harms Associated with Low Carbon Actions for TransformTO

PHASES AND STEPS OF THE STANDARDISED DECISION PROCEDURE

SHORT DESCRIPTION OF EACH STEP



A stakeholder analysis is performed by the city experts to identify all the stakeholder groups that affect or be affected by the climate project; representatives are engaged in the process.

The baseline emission inventory is established by the city experts; Local stakeholders are only involved as information providers (e.g. household energy consumption data).

Business as usual (BaU) scenarios and target scenarios are developed by the city experts; Again, local stakeholders are only involved as information providers.

Short-, medium- and long-term targets are established by the city authority on the basis of the baseline emissions and their development in future (Step II and III)

Actions are identified from literature, CAPs from other similar cities, etc. and grouped into strategies by city experts; A shared short list is established in consultation with local actors.

Criteria are defined in consultation with local actors against which the alternatives will be evaluated.

The effects of each alternative on each criterion are calculated by the city experts using current data from literature, consultations with external experts, focus groups and surveys

The selection of the MCDA method is performed by the analyst, who would have to make clear the stages of the selected MCDA process to non-specialist stakeholders.

The analysts helps local stakeholders to determine their preferences on the dominance relations and the relative importance of each criterion through surveys and translates them into thresholds and weights (depending on the method)

The application of the selected MCDA method is performed by the analyst and usually results in a ranking of the alternatives from the most to the least optimal,

The analyst tests how changes in model parameters (e.g. scorings and weights) affect the results (ranking) to conclude on their robustness

Proposal:

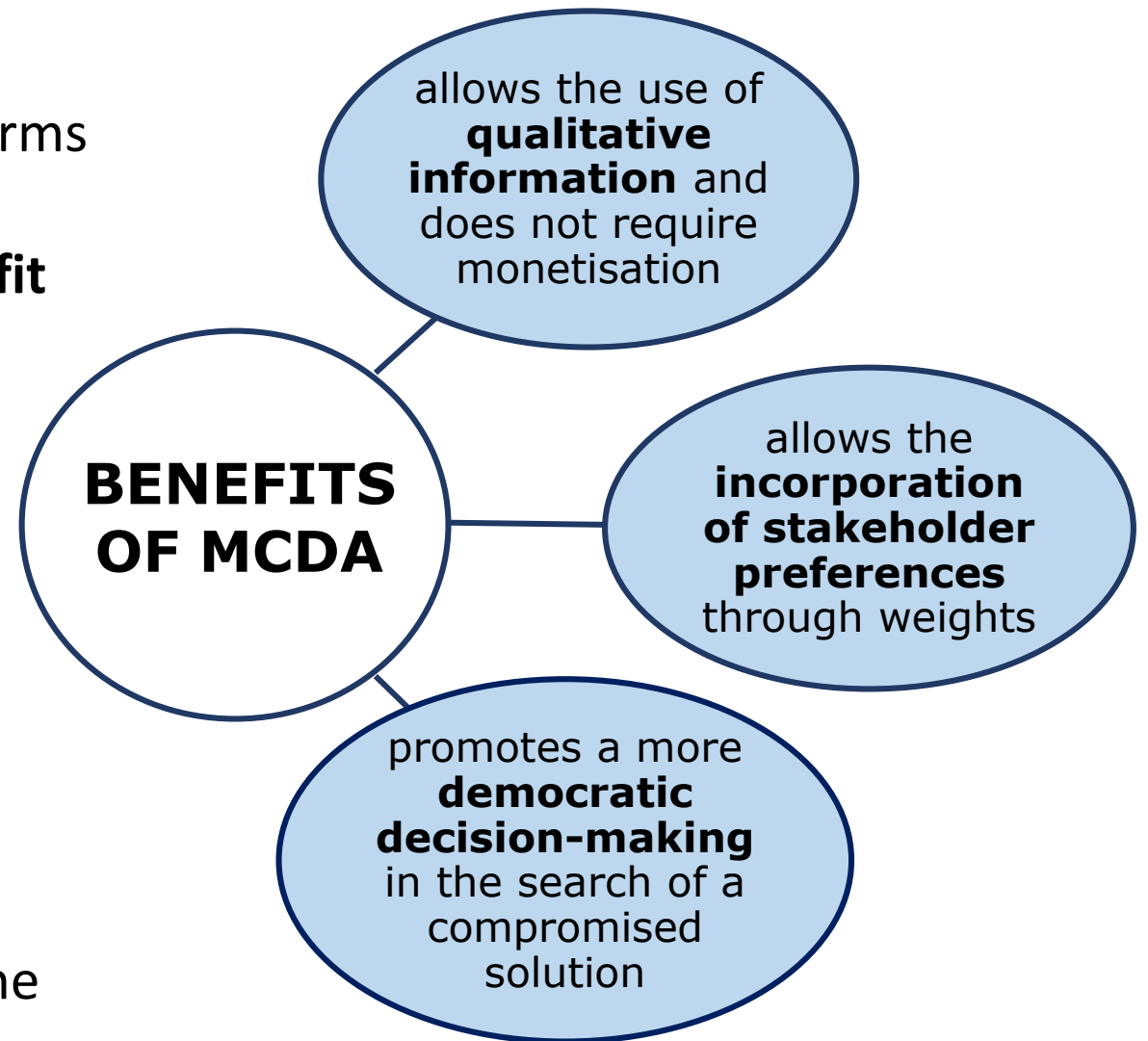
An 11-step general participatory framework for guiding collaborative action prioritisation on the basis of Multi-criteria Decision Analysis (MCDA)

FOCUS

- Step V: Definition of possible actions
- Step VI: Definition of the criteria to evaluate and compare actions

Why MCDA?

- The most employed and widely accepted forms of analysis among governments are **Cost-effectiveness analysis (CEA)** and **Cost-Benefit Analysis (CBA)**...
- **CEA**: limited to identifying the most “cost-effective” action for achieving a single objective – inappropriate for evaluating options with co-impacts
- **CBA**: can incorporate co-impacts, but necessitates their monetisation
- Although MCDA is **not as standardised** as the other methods, it offers advantages:



How to define possible actions?

- Possible sources:
 - Generic catalogues and examples of climate actions
 - Climate Action Plans (CAPs) of other cities
 - Implementation experiences in other cities

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 - **Implementation experiences in other cities**



Problem/ Point of attention: Each city has its own geographic, socio-economic and political context –
An action proved to be effective in one city may not be in another!

Learning from experience: The issue of contextualisation...

- In most climate action resources for cities a lack of contextualization is evident
- **Example:** EU CoM provides a **good practice database** of more than 6000 examples of measures, with the only **context specific factors** provided to filter the provided real examples are the **population** and **country** – **lost opportunity of tailor-made learning experience!**

Case Study Docking Station (Beta)

Welcome to the UCCRN Case Study Docking Station.

Search ARC3.2 Case Studies by keyword, topic, location, city size, latitude range, and more below.

Search	<input type="text"/>
Chapter	<input type="text" value=""/>
City	<input type="text" value=""/>
Country	<input type="text" value=""/>
Continent	<input type="text" value=""/>
Coastal	<input type="text" value=""/>
City Size (Population)	<input type="text" value=""/>
Latitude Range	<input type="text" value="Equatorial"/>
Human Development Index (HDI)	<input type="text" value=""/>
Gross National Income (GNI)	<input type="text" value=""/>

Cloud Database by Caspio

UCCRN's case study docking station: A good starting point & example...

- The online case study docking-station hosted by Urban Climate Change Research Network (UCCRN)
- It currently includes more than 120 city case studies (26 European case studies).
- It allows cases can be searched and grouped by geographic, climate and socio-economic variables

Source: Urban Climate Change Research Network Case Study Docking Station (Available at: <http://uccrn.org/case-study-docking-station-overview/>)

How to classify actions into types?

- After identifying actions and grouping them under certain strategies comes the...
 - Identification of implementing stakeholders
 - Classification of actions into direct and indirect
- Good practice example (Right):** New York assigns lead actor per action and distinguishes between...
 - Major actions:** Actions for which the direct GHG emissions reduction can be quantified
 - Enabling actions:** Indirect actions that enable accelerate or multiply the effect of the major actions – e.g. campaigns, etc.

Screenshots from NYC's CAP*

2020 Climate Actions

LEGEND

SECTOR

- All Sectors
- Buildings
- Energy
- Transportation
- Waste

GHG REDUCTION

- Major Reduction Potential Greater than 400,000 tCO₂e by 2030
- Moderate Reduction Potential Up to 400,000 tCO₂e by 2030
- Enabling, Accelerating, or Multiplying Effect

INVESTMENT

- > \$1 billion opportunity through 2030
- \$100 million - \$1 billion opportunity through 2030
- \$10 - \$100 million opportunity through 2030
- \$0 - \$10 million opportunity through 2030

Lead City Agency names listed in full on page 62

	ACTION	LEAD	GHG REDUCTIONS	CITY INVESTMENT	NON-CITY INVESTMENT
REDUCED AND MORE EFFICIENT CONSUMPTION	Implement long-term energy intensity requirements in existing buildings	MOS	Major Reduction Potential	\$ \$ \$ \$ \$	\$ \$ \$ \$ \$
	Accelerate deep energy retrofits to achieve a 20% deeper reduction in energy consumption in City-owned buildings by 2025	DCAS	Moderate Reduction Potential	\$ \$ \$ \$ \$	\$
	Continue progress toward New York City Housing Authority's (NYCHA) climate commitments, including 20% reduction of energy use per square foot by 2025, installing 25 Megawatts (MW) of solar capacity by 2026, and 30% reduction of GHG emissions by 2027	NYCHA	Moderate Reduction Potential	\$ \$	\$ \$ \$ \$
	Advocate for more stringent efficiency standards for appliances and vehicles at the regional and national levels	MOS	Enabling, Accelerating, or Multiplying Effect	\$	not assessed
	Advocate for incentives to support deep energy retrofits focusing on preserving affordability	MOS	Enabling, Accelerating, or Multiplying Effect	\$	not assessed
	Implement advanced energy codes for new buildings in 2019, and achieve very low energy design targets in all new buildings and major renovations in subsequent code cycles	MOS & DOB	Major Reduction Potential	\$	\$ \$ \$ \$ \$

* Source: NYC Climate Action Plan. (2017). 1.5°C: Aligning New York City with the Paris Climate Agreement. New York City Government

How to define criteria?

Review of criteria used in exist. MCDA models

- **Question 1:** Do action plans refer to the use of some kind of criteria that helped in the choice of actions ?
- ✓ **Survey 1:** the CAPs of the 17 city members of Carbon Neutral Cities Alliance (CNCA) were investigated - only 2 – the City of Toronto and New York City – present a distinct prioritization approach.

How to define criteria?

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- **Question 1:** Do action plans refer to the use of some kind of criteria that helped in the choice of actions ?
- ✓ **Survey 1:** the CAPs of the 17 city members of Carbon Neutral Cities Alliance (CNCA) were investigated - only 2 – the City of Toronto and New York City – present a distinct prioritization approach.
- **Question 2:** Can a set of generic criteria against which decision makers (DM) can evaluate climate actions as part of an MCDA framework be identified?
- ✓ **Survey 2:** 10 selected sources were investigated, including Toronto's and NYC's prioritization frameworks, open access decision support tools for city-level climate action planning, etc. – it was observed that...

Survey 2: Main observations

Criterion group	Criterion	[41]	[28]	[27]	[42]	[43]	[30]	[29]	[40]	[37]	[10]
Feasibility criteria (Efforts required)	Economic			o	-	✓	✓	✓	✓	✓	✓
		Initial investment cost		o	-	✓	✓	-	o	-	✓
		Annual running costs			-	-	✓	-	-	-	✓
		Return on investment (ROI)	-	✓	-	-	-	-	-	-	✓
		External funding programmes	-	-	-	-	✓	-	-	-	✓
	Regulatory	National regulation necessity	✓		✓	-	✓	-	-	-	-
	Technical	Level of technical difficulty			✓	-	✓	-	-	-	✓
	Temporal	Speed of implementation			✓	✓	-	✓	-	-	✓
	Social	Citizen acceptability	-	-	✓	-	✓	-	-	-	✓
		Stakeholder acceptability	-	-	✓	-	✓	-	-	-	-
	Social compatibility (mainstreaming potential)	-	-	-	-	✓	-	-	-	-	
Governance	Level of city power	-	-	-	✓	-	✓	✓	✓	-	
Impact criteria	Climate-related								✓	✓	✓
	Economic	Effectiveness (GHG emissions saving potential)							✓	✓	✓
		Private investment mobilization potential	✓	-	-	-	o	-	✓	✓	-
	Socio-economic	Generation of additional jobs					o	✓	✓	✓	-
		Affordable housing	o	-	-	-	o	-	✓	✓	-
		Energy poverty	o	-	-	-	o	-	✓	✓	-
		Exemplarity/image	-	-	-	✓	o	-	-	✓	✓
	Enviro-economic	Deferred infrastructure	-	-	-	-	o	✓	-	✓	-
		Renewable energy produced	-	✓	-	-	o	✓	-	✓	-
	Environmental impacts	Adaptability to climate change	✓	-	-	-	o	-	-	✓	o
		Energy resource use	✓	✓	-	-	o	✓	-	o	o
		Other resource use (e.g. water, material, land)	-	-	-	-	o	-	✓	o	o
		Biodiversity conservation	✓	-	-	-	o	✓	-	-	✓
	Socio-environmental	Health: Air quality	o	-	-	-	o	✓	✓	✓	-
		Health: Waste management	o	-	-	-	o	✓	-	-	✓
		Preserve cultural heritage	✓	-	-	-	o	-	-	o	o
	Social	Comfort	-	-	-	-	o	✓	✓	-	✓
	Noise pollution	-	-	-	-	o	-	-	✓	✓	
	Aesthetic quality	-	-	-	-	o	-	-	-	✓	
	Social mobilisation potential	✓	-	-	-	o	-	✓	-	✓	

Most common type of criteria

2nd most common type of criteria

- The dominant pattern in prioritization: **cost-effective** and **quick-win** actions

Note 1: "✓" indicates that the parameter is explicitly mentioned; "o" indicates that it may form part of a broader category
 Note 2: In some sources the cost(s) and revenue(s) (financial feasibility) are examined as part of marginal abatement curves (cost-effectiveness), e.g. [40]

Co-Benefits as a business case to justify the capital investment...

- Cities will need to **move beyond low cost and quick win opportunities** and pursue more investment intensive ones that take longer to play out but will be critical in achieving the required decarbonisation by 2030/2050 – such as urban densification and land-use planning.
- **Business case for including such actions:** their co-benefits – i.e. benefits that actions generate beyond their contribution to GHG emissions reductions.
- Beyond addressing climate change, **contributions may be achieved to other local sustainability objectives** in areas such as health, safety, housing, air quality, land use, poverty reduction and local economic development.

Co-Benefits as a business case to justify the capital investment...

Climate strategies and actions with co-benefits...

- (1) Can result in **win-win situations** and can be proved to be more **cost-effective**
- (2) Are likely to be **more supported** by more diverse communities of interest (also as investors)

HOWEVER

- (1) Requires understanding and quantifying complex relationships between different systems and aspects
- (2) Actions may also be associated with unintended adverse impacts (co-harms).

Survey 2: Main observations on co-impacts

- Although an **increasing interest in including co-benefits** is observed, the inclusion of a larger list of sustainability indicators to account for positive side effects of actions as criteria in an MCDA model is **still not the norm**.
- Most guides solely use expressions such as “co-benefits” or “multiple benefits” introducing a positivity bias towards the impacts – **“trade-offs”/“co-harms” are not acknowledged**.

Survey 2: Main observations on co-impacts

- Attempts to develop an ordinal scoring method for quantifying the qualitative mapping the synergies and trade-offs between specific climate actions and other objectives.

- **Example:** New York City's plan employs a five-scale qualitative system:



Source: C40 2017 Case Study: Action Prioritisation Methodology Applied for New York City's 1.5 °C Climate Action Plan (Available at: <https://resourcecentre.c40.org/>)



How NYC presents the co-benefits per action

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	Advocate for more stringent efficiency standards for appliances and vehicles at the regional and national levels	MOS	Enabling, Accelerating, or Multiplying Effect	\$0 - \$10 million opportunity through 2030	not assessed
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Screenshots from NYC's CAP

Source: NYC Climate Action Plan. (2017). 1.5°C: Aligning New York City with the Paris Climate Agreement. New York City Government

ONE NYC VISION

- Growth
- Equity
- Sustainability
- Resiliency

BENEFIT POTENTIAL

- Major Potential Benefit
- Moderate Potential Benefit
- Some Potential Benefit

GROWTH EQUITY SUSTAINABILITY RESILIENCY

	QUALITY JOBS	ECONOMY AND INNOVATION	WORKFORCE DEVELOPMENT	LONG-TERM COST SAVINGS	HEALTH AND WELLBEING	SAFETY	AFFORDABILITY	ACCESS	COMMUNITY	LEAD BY EXAMPLE	RESILIENCY	RELIABILITY	NATURAL CAPITAL
QUALITY JOBS	Major	Major	Moderate	Major	Major	Some	Major	Major	Some	Major	Major	Major	Major
ECONOMY AND INNOVATION	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
WORKFORCE DEVELOPMENT	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
LONG-TERM COST SAVINGS	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
HEALTH AND WELLBEING	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
SAFETY	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
AFFORDABILITY	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
ACCESS	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
COMMUNITY	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
LEAD BY EXAMPLE	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
RESILIENCY	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
RELIABILITY	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major
NATURAL CAPITAL	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major	Major

SPOTLIGHT: QUALITY JOBS

Potential to create 17,000 new construction-related jobs through 2030

SPOTLIGHT: HEALTH, WELLBEING, AND EQUITY

IMPROVING AIR QUALITY BY REDUCING FOSSIL FUEL USE

DECREASE IN PM2.5 EMISSIONS (TONS/YEAR)

- < 5
- 5 - 10
- 10 - 20
- > 20

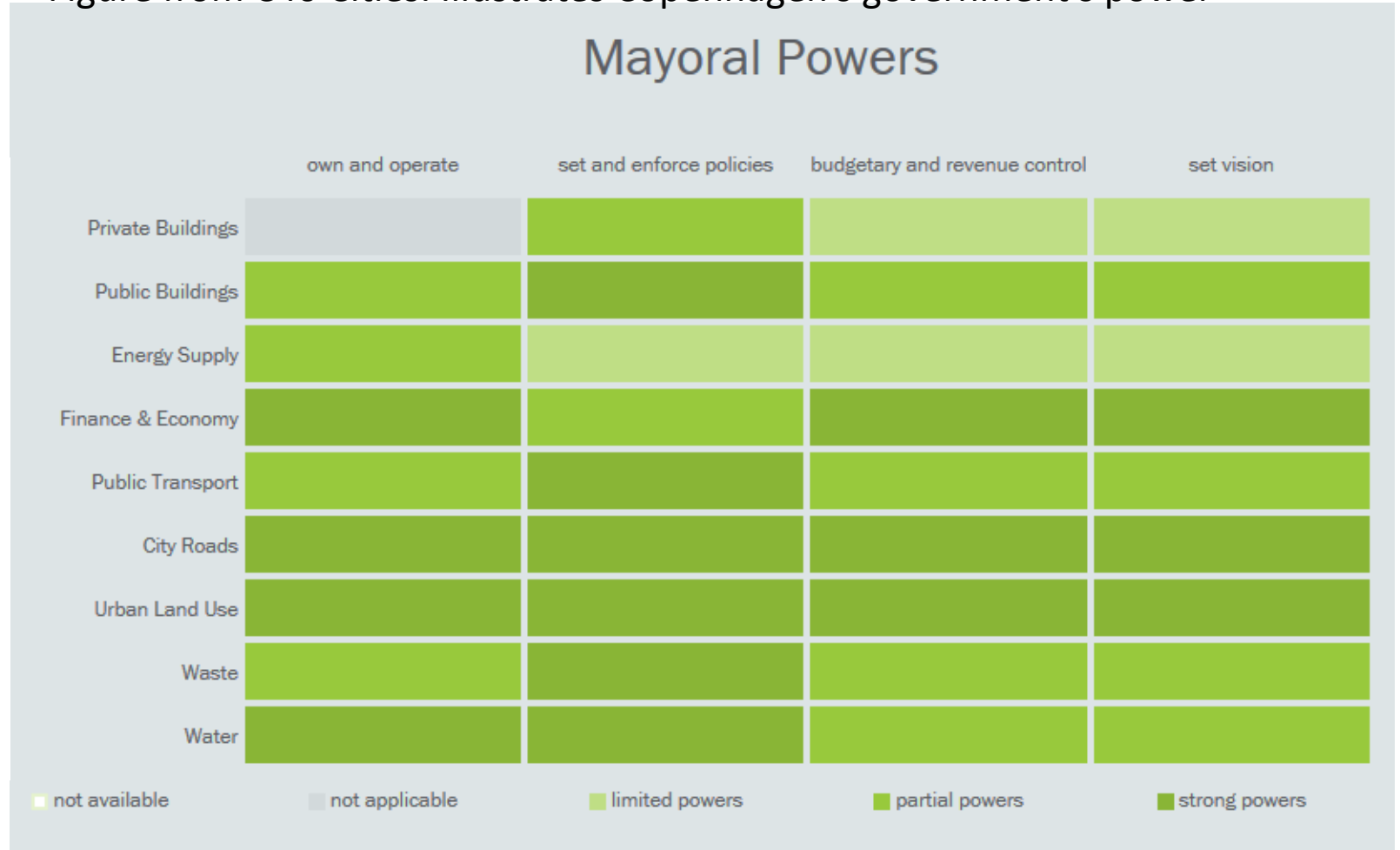
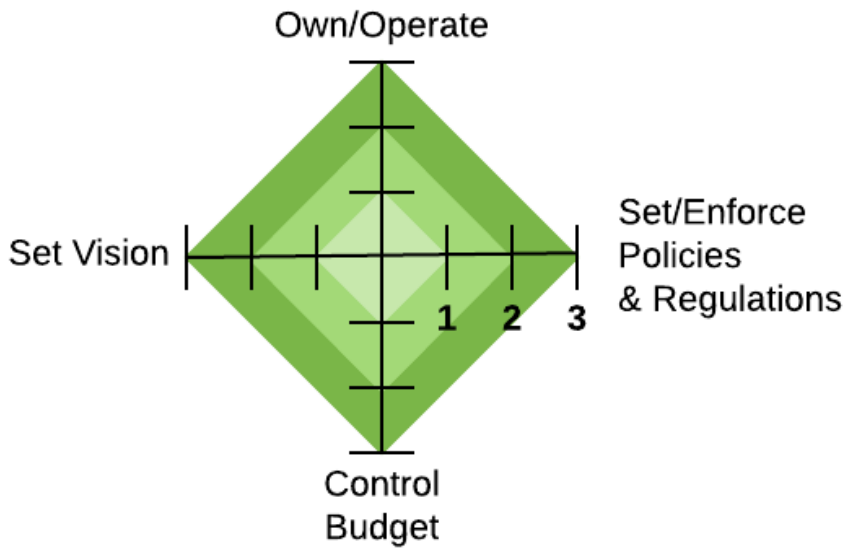
Neighborhoods Above City-Wide PM2.5 Attributable Asthma Rate

Survey 2: “Level of power” as another underrepresented criterion

- It is also **significant that cities consider their “level of power”** - either as a criterion in the overall action prioritization exercise or as the starting point for a first shortlisting of actions, which are later evaluated and prioritized against all other criteria
- Again, this criterion is **not as highlighted as expected** in the different guides.

Example: Ordinal scale for “rating” mayoral powers by C40 Cities

*Figure from C40 Cities. Illustrates Copenhagen’s government’s power



*Source: <https://www.c40cities.org/cities/copenhagen>

Conclusions

- **Prioritizing implementation efforts:** In a constrained environment, resources should be allocated to those actions which deliver the most benefits from a holistic point of view as well as the least co-harms.
- **Maximizing GHG emission savings from those actions with the greatest co-benefits:** Municipalities should seek to innovate with strategies with co-benefits in order to achieve more GHG emissions reductions instead of choosing actions resulting in fewer co-benefits.
- **MCDA allows for a systematic and transparent evaluation of the co-impacts** that actions will generate.

However, not as easy as it sounds...

- quantifying stakeholder's preferences and a great number of criteria may be a laborious and time-consuming process.
- For this reason, city governments, when faced with limited resources, should make effective use of all ready-at-hand existing tools to support this task.

Call for action: Next steps in research to improve & accelerate the implementation of such a framework

1. TO FACILITATE/ACCELERATE THE DEFINITION OF ACTIONS...

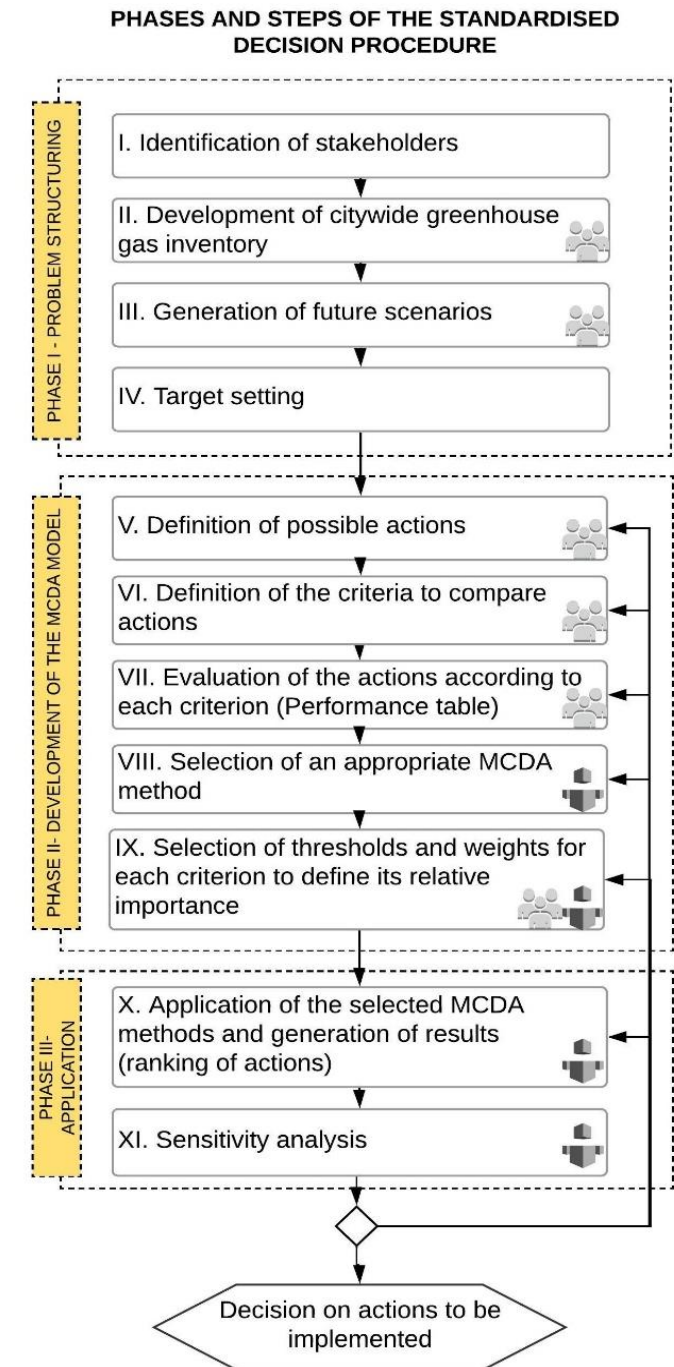
- create a **common database of best practice climate actions** in cities **with “filters”** to enable local authorities to focus on cities with similar geographic and socioeconomic context – this can become part of the future activities of GCoM

2. TO FACILITATE/ACCELERATE THE EVALUATION OF ACTIONS...

- develop **“co-impacts” tools** assisting their integration into the prioritization of actions.

3. TO FACILITATE/ACCELERATE THE ENTIRE PROCEDURE...

- create **group-decision making software tools especially designed for the action planning task** to guide municipalities throughout the entire action prioritization process/ streamline the communication process between stakeholders



Thank
You!

Contact: maria.balouktsi@kit.edu