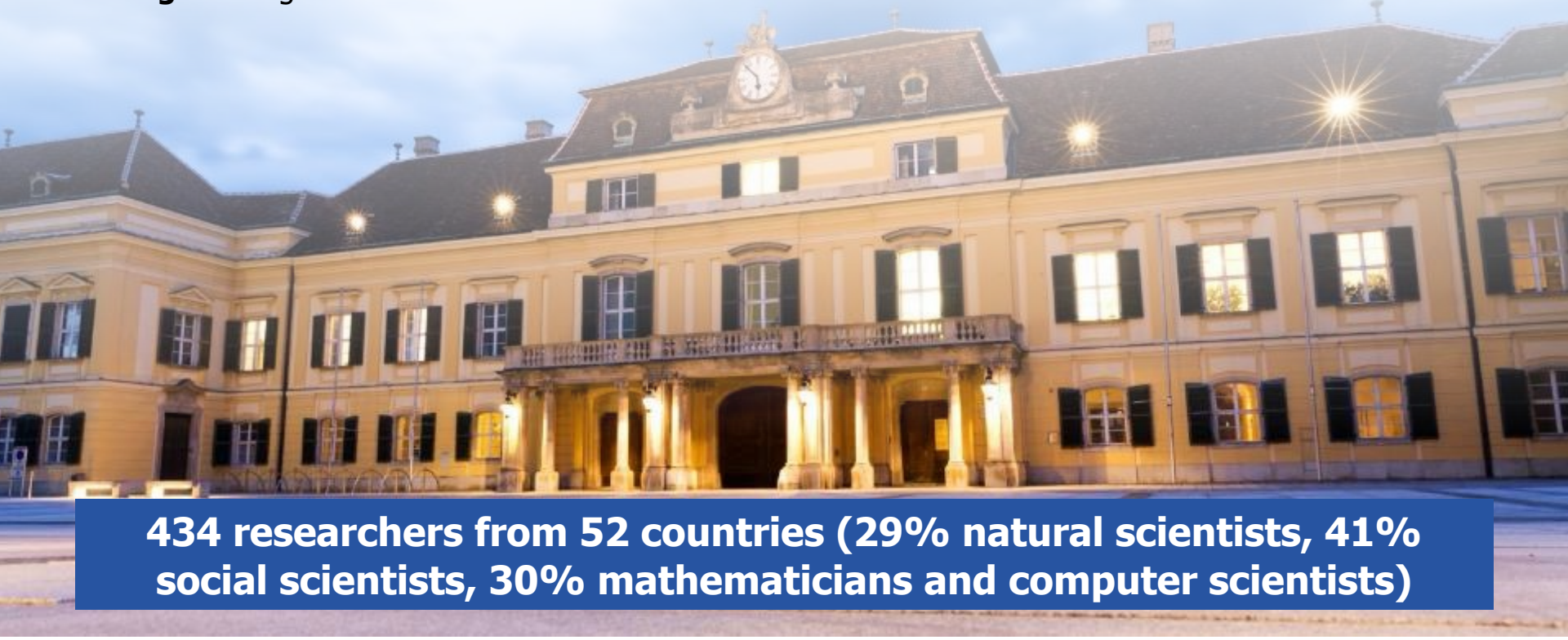
International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

# Importance of International Collaborations in Science and Research

Nadejda Komendantova
Cooperation and Transformative Governance (CAT) Group

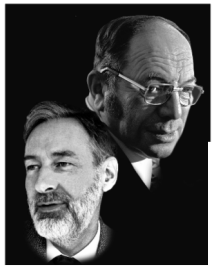
# IIASA is…

An international research institute that conducts **multidisciplinary/ transdisciplinary research** to help policymakers find long-term solutions to **global and universal challenges** facing countries



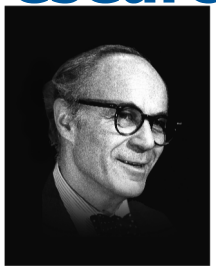
**434 researchers from 52 countries (29% natural scientists, 41% social scientists, 30% mathematicians and computer scientists)**

# Since 1972, IIASA has attracted some of the world's best researchers



Prof. Tjalling Koopmans *and* Prof. Leonid Kantorovich
**Nobel Prize in Economics**

**1975**

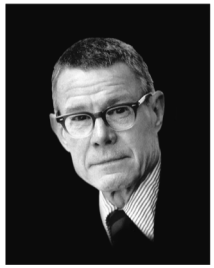


Prof. Lawrence Klein
**Nobel Prize in Economics**

**1980**

Prof. Paul Crutzen
**Nobel Prize for Chemistry**

**1995**



Prof. Thomas C. Schelling
**Nobel Prize in Economics**

**2005**

Authors of the Intergovernmental Panel on Climate Change Reports
**Nobel Peace Prize**

**2007**

Prof. William Nordhaus
**Nobel Prize in Economics**

**2018**

ABOUT IIASA

# History – A child of science diplomacy

1967: US President Lyndon Johnson and the USSR Premier Alexey Kosygin met in Glassboro. One discussion item: to establish an international scientific institute to use scientific cooperation to build bridges across the Cold War divide.

1972: In London at the Royal Society, representatives of 12 countries including the Soviet Union and the United States sign the charter establishing IIASA.

1972 to date: Austria hosts IIASA, providing a rent-free former palace as its headquarters and bestowing the privileges of an international organization to the Institute.

MEMBERSHIP

# Research focus

**CAT Group:** Interdisciplinary approach on governance and decision-making processes under uncertainty, complexity, ambiguity and volatility while incorporating systems thinking into strategic policy planning, addressing social dilemmas and wicked policy issues

**1/** Cooperation models

**2/** Decisions support systems

**3/** Participatory modelling

# Methods in CAT group

## Cooperation models

- Game-theoretical models for public good and common pool management with real-world complexities
- Including bounded rationality, social heterogeneity, cultural dispositions, and institutional incentives

## Decision support systems

- Problem structuring methods
- Including prioritization of criteria, connection of drivers and criteria elicitation, selection of background influences, formulation of strategic goals, selection of most important drivers

## Participatory modelling

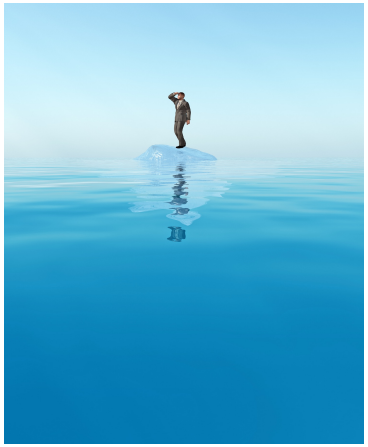
- Multi-criteria optimization and prioritization
- Systems mapping and morphological analysis
- Participatory scenario planning

# Cooperation and Transformative Governance Group Role in Science Diplomacy

- Providing insights into understanding of social dynamics while finding efficient and sustainable governance solutions, based on game theoretical models,
- Supporting decision-making processes on societal transformations and transitions, based on multi-criteria analysis,
- Bringing confronting parties into a dialogue on contested and wicked policy issues, based on participatory modelling.

# Challenges of policy planning

Many policy planning processes are characterized by:



"Deep uncertainty"

Data scarcity, incompleteness, ambiguity

Requirements of policy feasibility for and ownership by stakeholders

Urgency in providing solutions

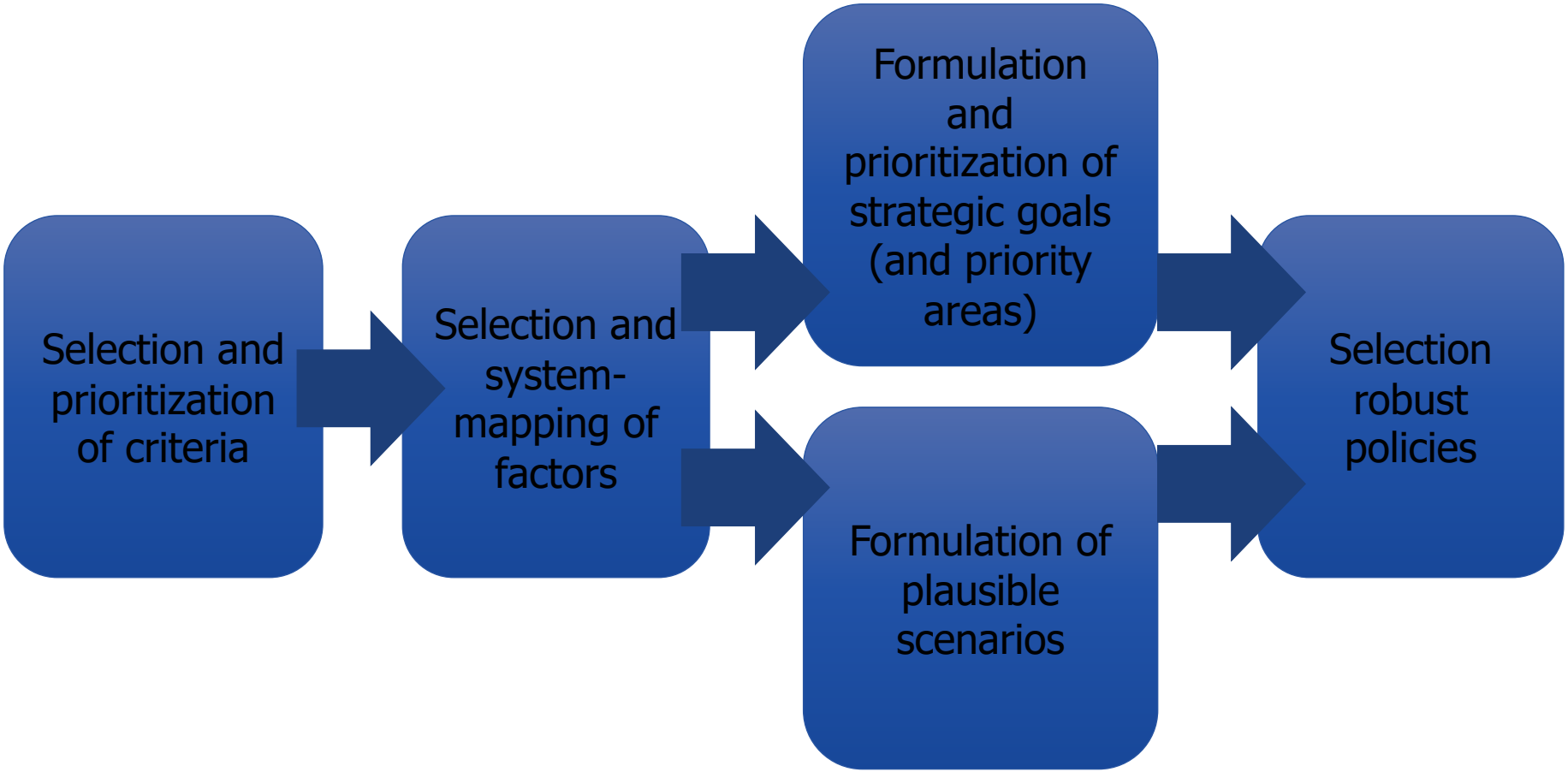
# Methods of Systems Analysis Toolkit (SAT) developed by IIASA can help

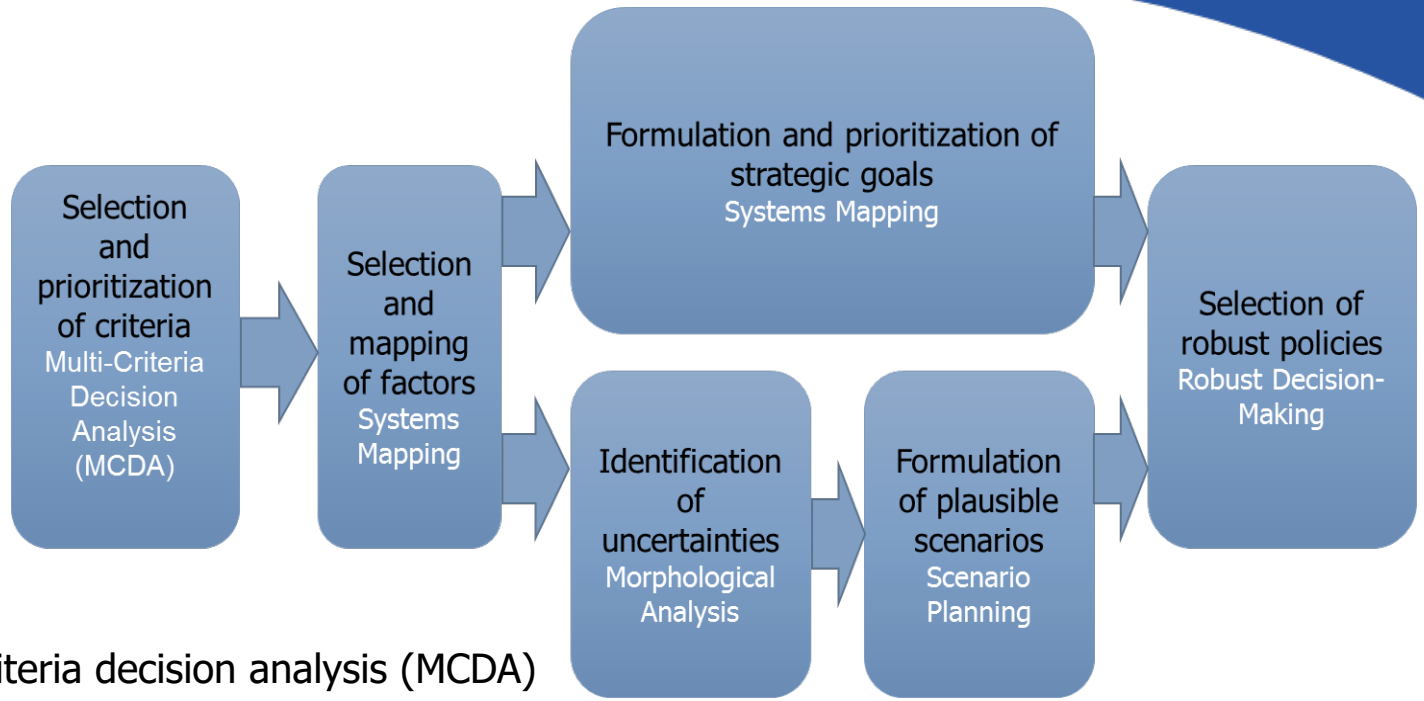
Structure the problem
and
assist in sense-making

Find compromise
among stakeholders

Provide social
learning and
exchange of
best practices

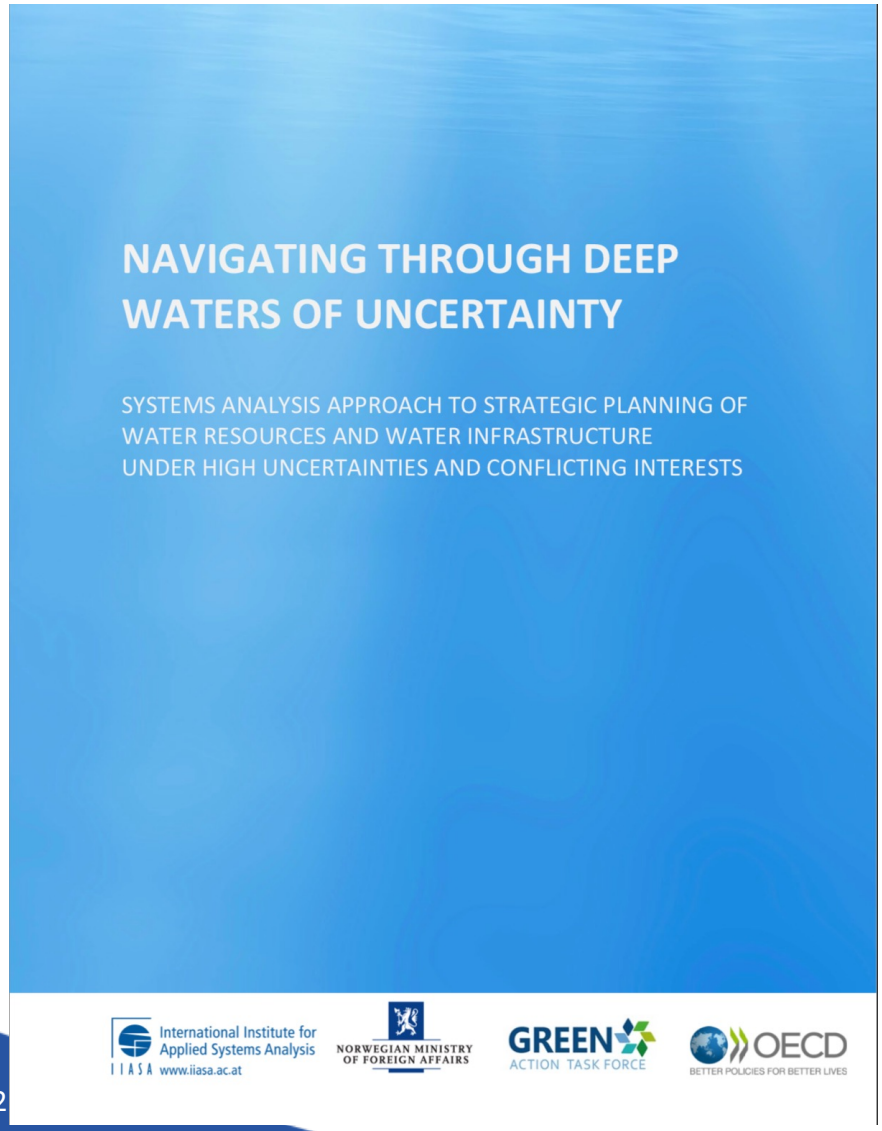
# Compromise based policy solutions: SAT methodology

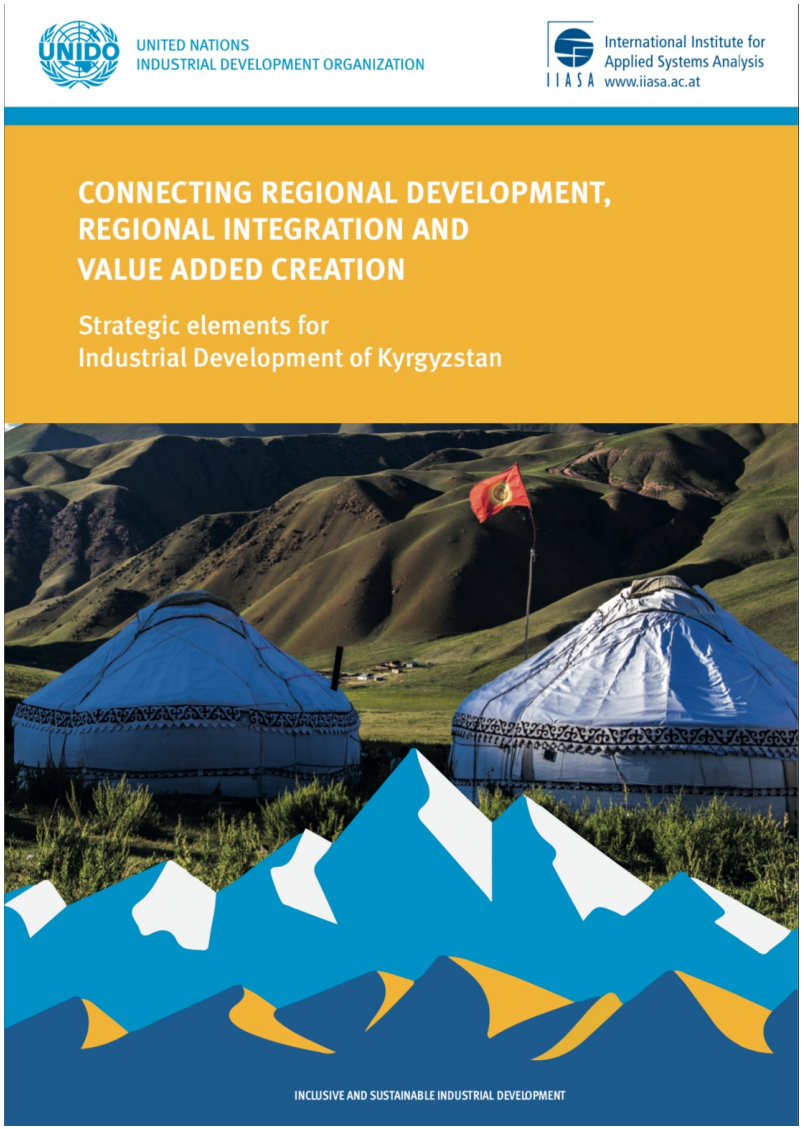





- Multi-criteria decision analysis (MCDA)
  - Elicitating and prioritizing **multiple stakeholder preferences** over competing goals
- Systems mapping
  - Creating a representation of the considered **system**, articulating its **boundaries**, components and **links** between them
- Morphological analysis
  - Revealing **uncertain factors** and their possible manifestations
- Scenario planning
  - Sketching **plausible futures** of the system's development
- Robust decision making
  - Creating a **portfolio of actions** to achieve the preferred goals under **all** scenarios

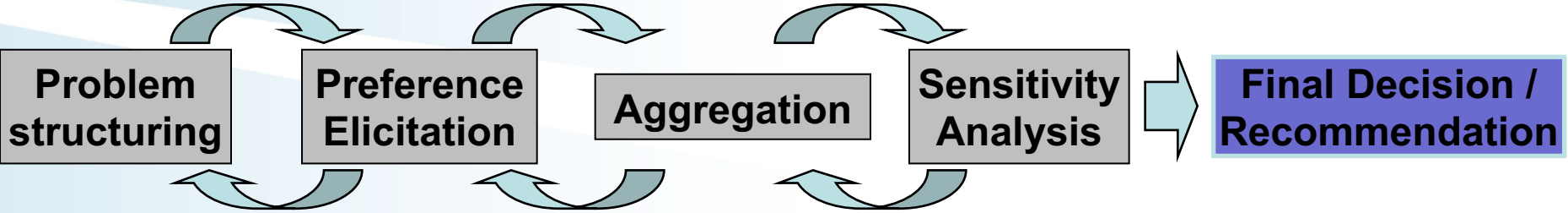
# Examples of application of SAT by Cooperation and Transformative Governance Group at IIASA



# Systems mapping factors in Kyrgyzstan

# Multi-Criteria Decision Making Tool

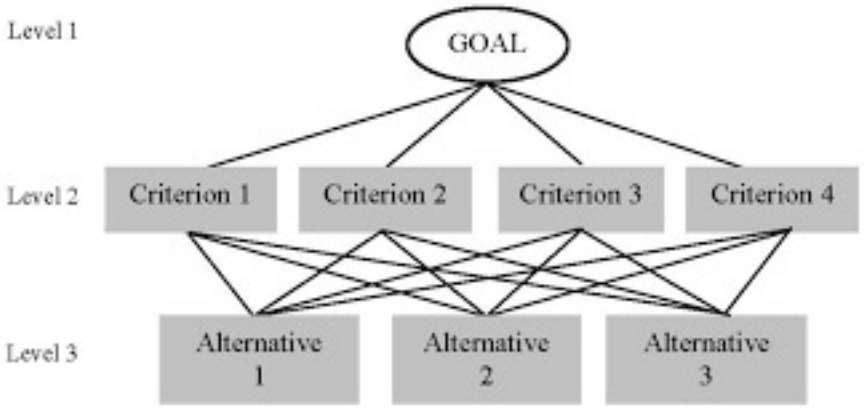



- Methodological approach that allows the structuring of the problem and identification of attributes relevant for decision making
- Set priorities following a group discussion – consensus reaching

1. Choices that one can make: which scenarios has the highest risk
2. Characteristics of scenarios: quantified by loss scores
3. Relative importance of different loss parameters: preferences and relative importance of different loss parameters (weights)

# Multi-criteria decision optimization

- Divides complex decisions into criterions, sub-criterions and allows to develop alternatives




- Increases transparency of decision-making processes

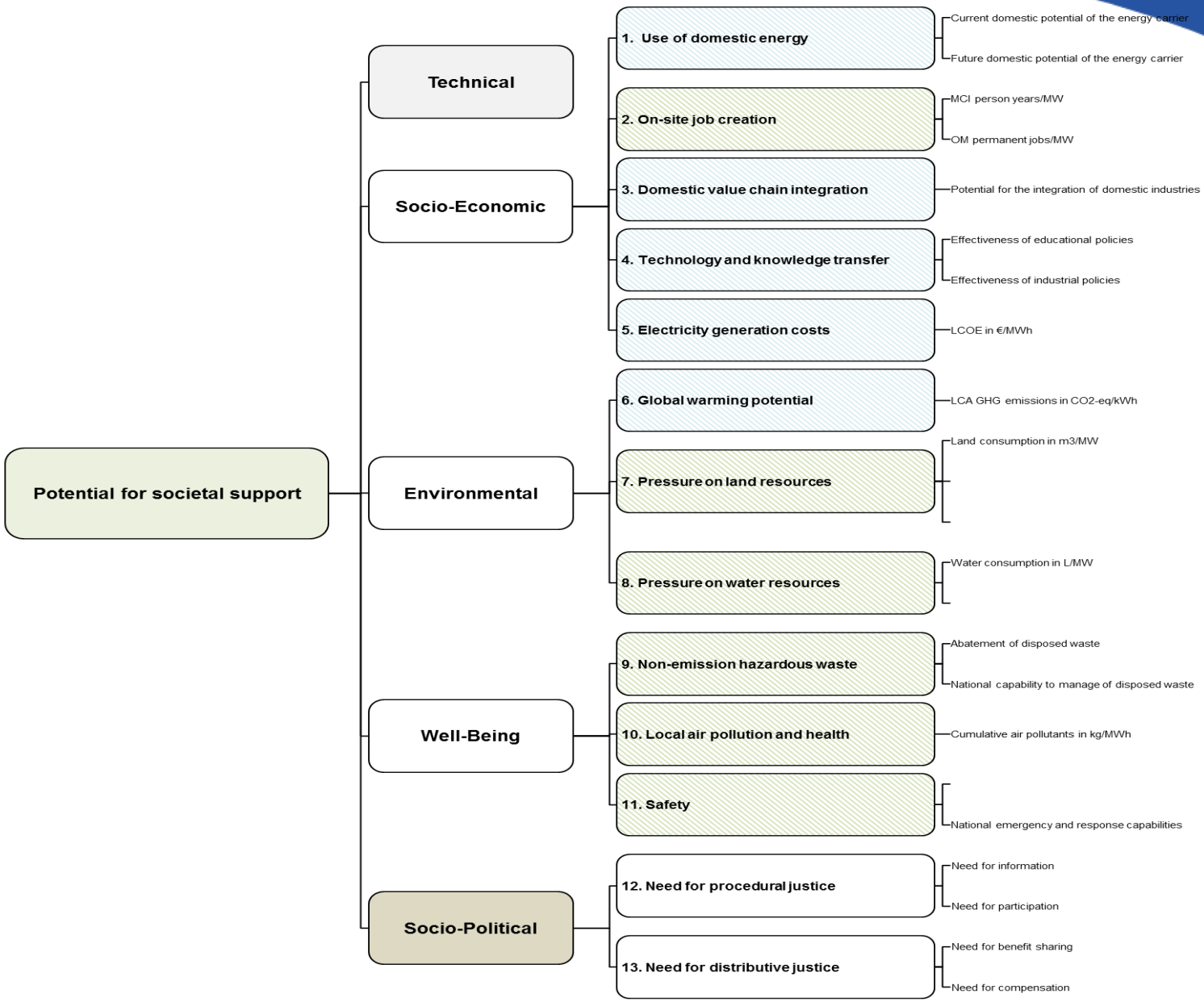
- Increases legitimacy of decision-making outcomes

- Addresses perceptions of procedural justice

# Middle East North African Sustainable Electricity Trajectories (MENA Select)

Investigates the socio-economic impacts, risks and opportunities, and potential for conflict, of different electricity scenarios and power production technologies in several countries within the MENA region.

- Renewable energies, fossil fuels (oil, coal, gas) and nuclear
- Several stakeholders workshops
- Each technology will be evaluated against a set of criteria


Potential for societal support
Technical
Socio-Economic
Environmental
Well-Being
Socio-Political
1. Use of domestic energy
Current domestic potential of the energy carrier
Future domestic potential of the energy carrier
2. On-site job creation
MCI person years/MW
OM permanent jobs/MW
3. Domestic value chain integration
Potential for the integration of domestic industries
4. Technology and knowledge transfer
Effectiveness of educational policies
Effectiveness of industrial policies
5. Electricity generation costs
LCOE in €/MWh
6. Global warming potential
LCA GHG emissions in CO2-eq/kWh
7. Pressure on land resources
Land consumption in m3/MW
8. Pressure on water resources
Water consumption in L/MW
9. Non-emission hazardous waste
Abatement of disposed waste
National capability to manage of disposed waste
10. Local air pollution and health
Cumulative air pollutants in kg/MWh
11. Safety
National emergency and response capabilities
12. Need for procedural justice
Need for information
Need for participation
13. Need for distributive justice
Need for benefit sharing
Need for compensation
Contribution to national energy and development objectives
Local conflict sensitivity

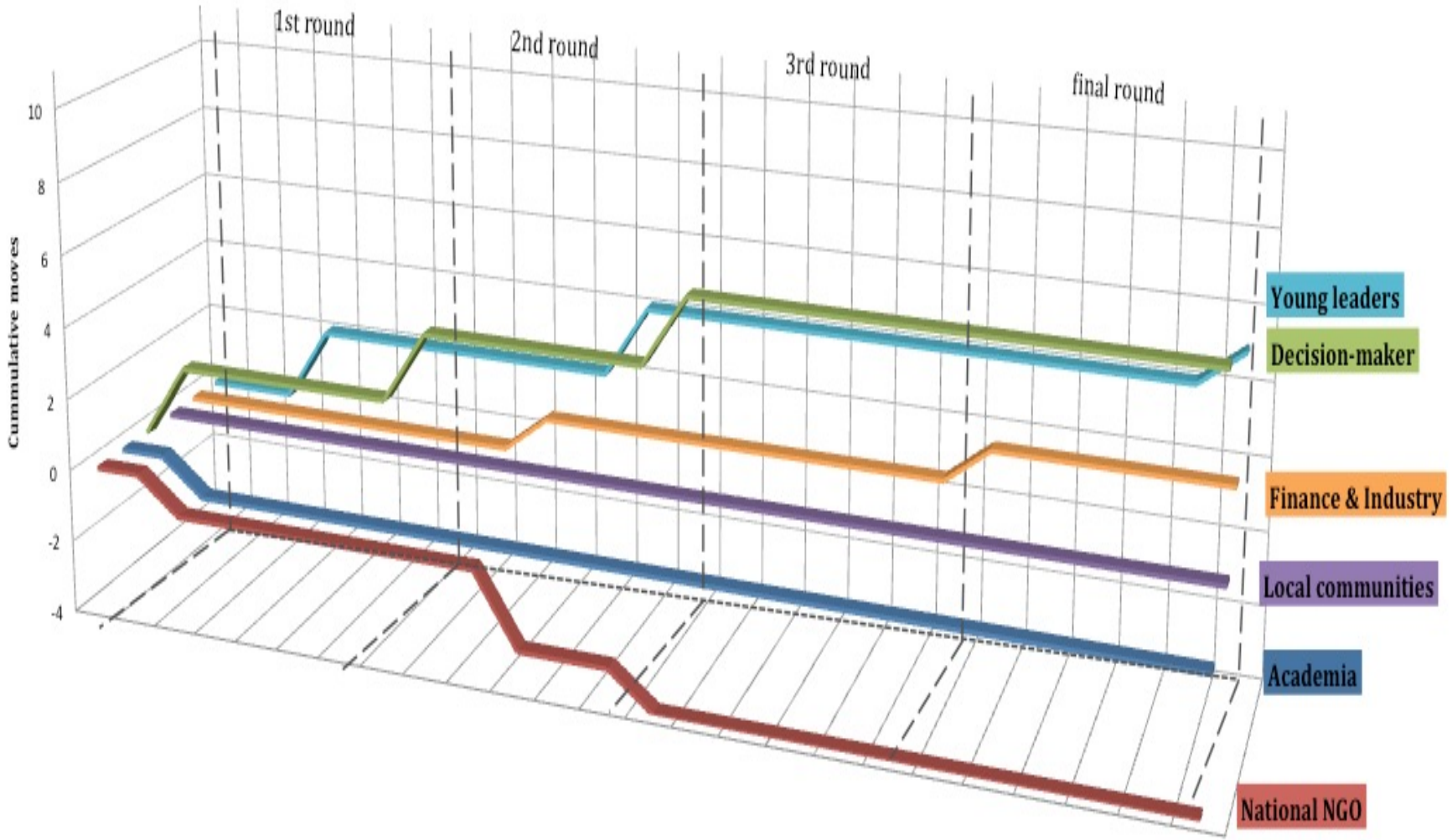
# Participatory process in Jordan

- Civil society and NGOs: Jordan Press Foundation, Energy Services Center, Renewable Energy Establishments Society, Jordan Environment Society, Renewable Energy Establishment Society, Jordan Energy Charter
- Finance and investment: Arab Bank, a number of private companies like Qatrana Cement
- Academia: five major Jordanian universities as well as several private research centers
- Future decision-makers
- Country representatives: mayors of communities where infrastructure is planned
- Political decision-makers: Ministry of Energy and Mineral Resources, Ministry of Water and Irrigation, Chamber of Industry, Ministry of Public Works, National Electric Power Company

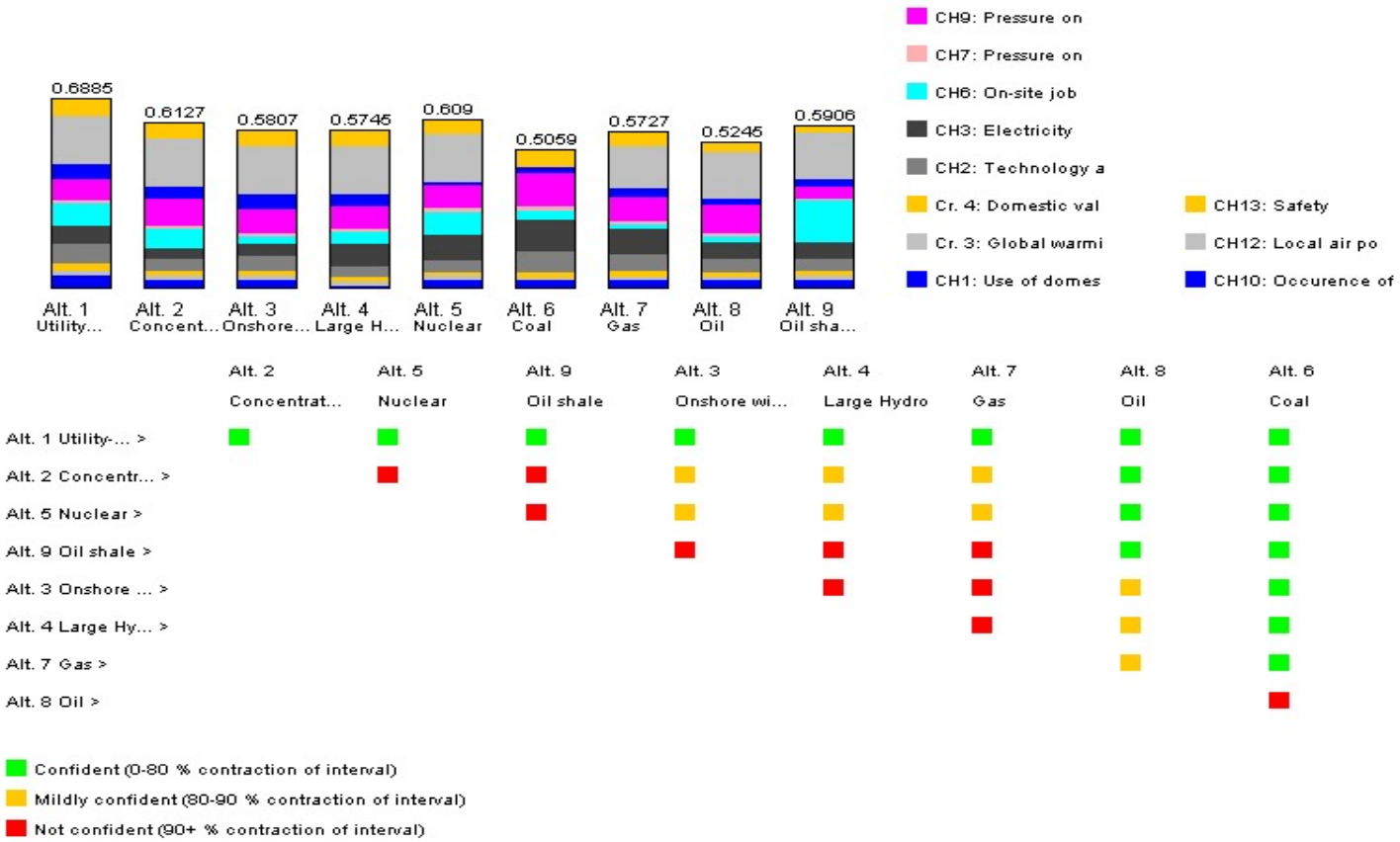
JORDAN - Qualitative criteria importance

| Stakeholders | Use of domestic energy sources | Global warming potential | Domestic value chain integration | Technology and knowledge transfer | Electricity system costs | On-site job creation | Pressure on land resources | Pressure on local water security | Non-emission hazardous waste | Local air pollution and health | Safety |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Young leaders | Moderate-low importance | Moderate-low importance | Least importance | Moderate importance | High importance | Moderate importance | Least importance | Moderate importance | Least importance | Moderate-low importance | High importance |
| National NGOs | Moderate-low importance | Moderate-low importance | Least importance | Moderate-low importance | High importance | Moderate-low importance | Least importance | Moderate-low importance | Least importance | Least importance | Moderate-low importance |
| Local communities | Least importance | High importance | Least importance | Least importance | High importance | Least importance | Least importance | Moderate-low importance | Least importance | Moderate-low importance | High importance |
| Academia | Moderate importance | Least importance | Moderate-low importance | Moderate importance | High importance | Moderate importance | Least importance | Moderate importance | Least importance | Moderate importance | Moderate-low importance |
| Finance/Industry | Least importance | High importance | Least importance | Least importance | High importance | Least importance | Least importance | Moderate-low importance | Least importance | Moderate-low importance | High importance |
| Policy-makers | Moderate importance | Least importance | Moderate-low importance | Least importance | Moderate importance | Least importance | Moderate-low importance | Least importance | Least importance | Least importance | High importance |
| Compromise | Moderate-low importance | Least importance | Least importance | Moderate-high importance | Moderate-high importance | High importance | Least importance | Moderate-high importance | Moderate-low importance | High importance | Moderate-low importance |

# JORDAN - Group divergence and convergence on "Safety"



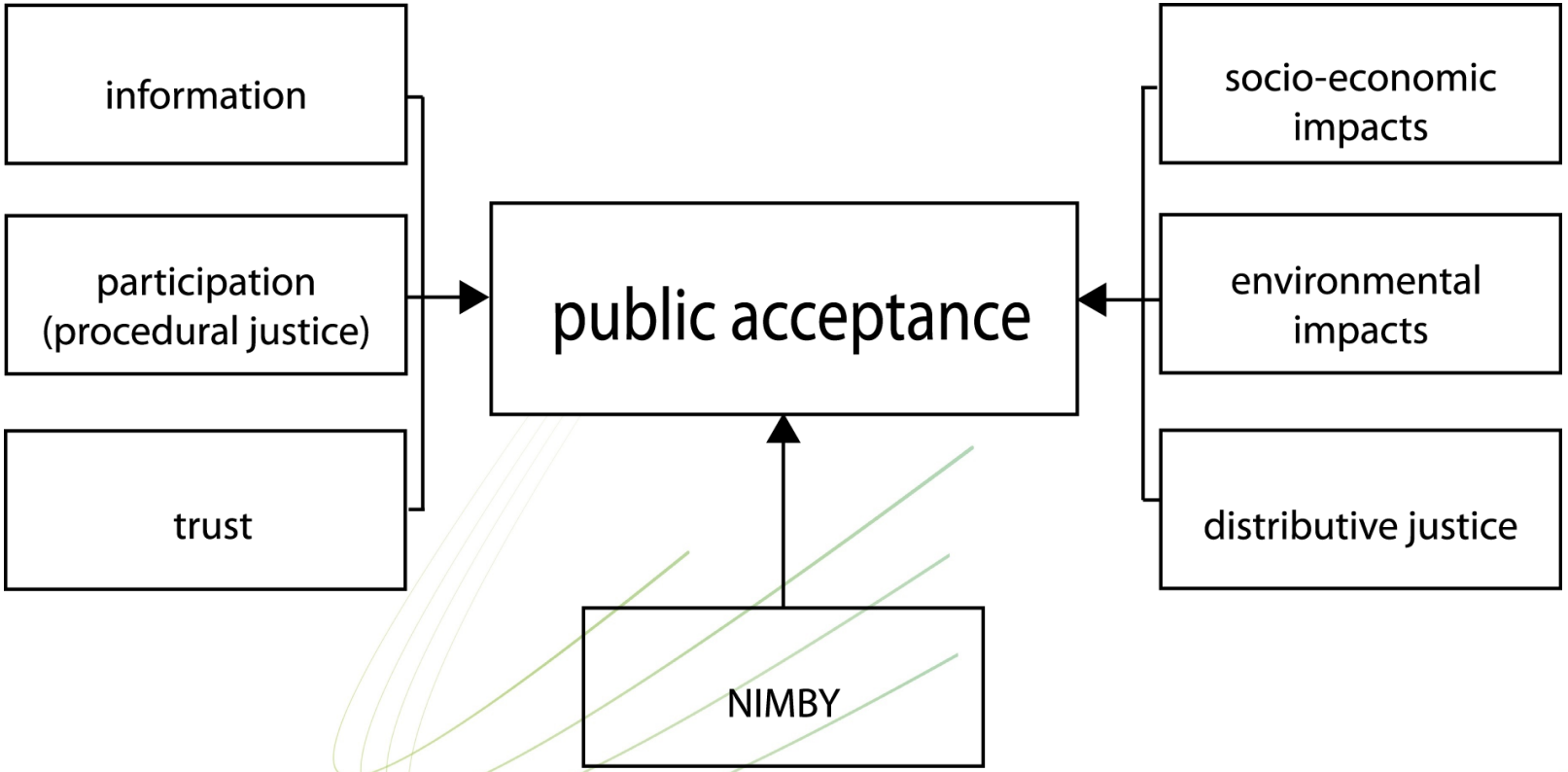
# Trade-off on technologies



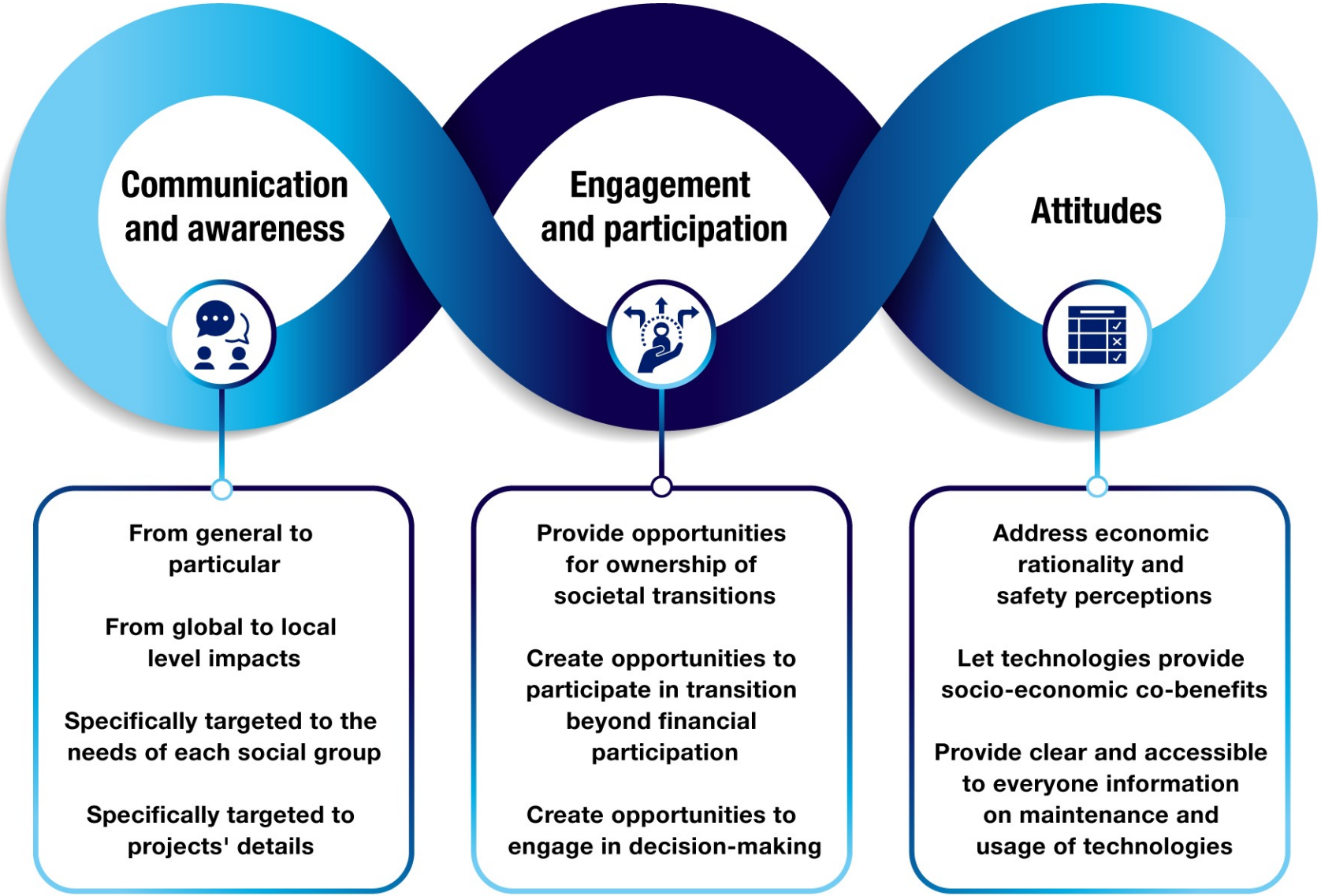

**Conclusion:** "Alt. 1 Utility-scale Photovoltaic (PV)" is the best alternative, with "Alt. 2 Concentrated Solar Power" as runner up.
The Alt. 1 > Alt. 2 statement is confident, since the information provided in this decision basis supports a strict ranking with a degree of 22 %, whereas the reverse statement is not supported.

Source: MENA-SELECT project, results generated with DecideIT

# Drivers of acceptance



# Communication, engagement, and attitudes cycle




Source: Komendantova, Energy Research and Social Science, 2020

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