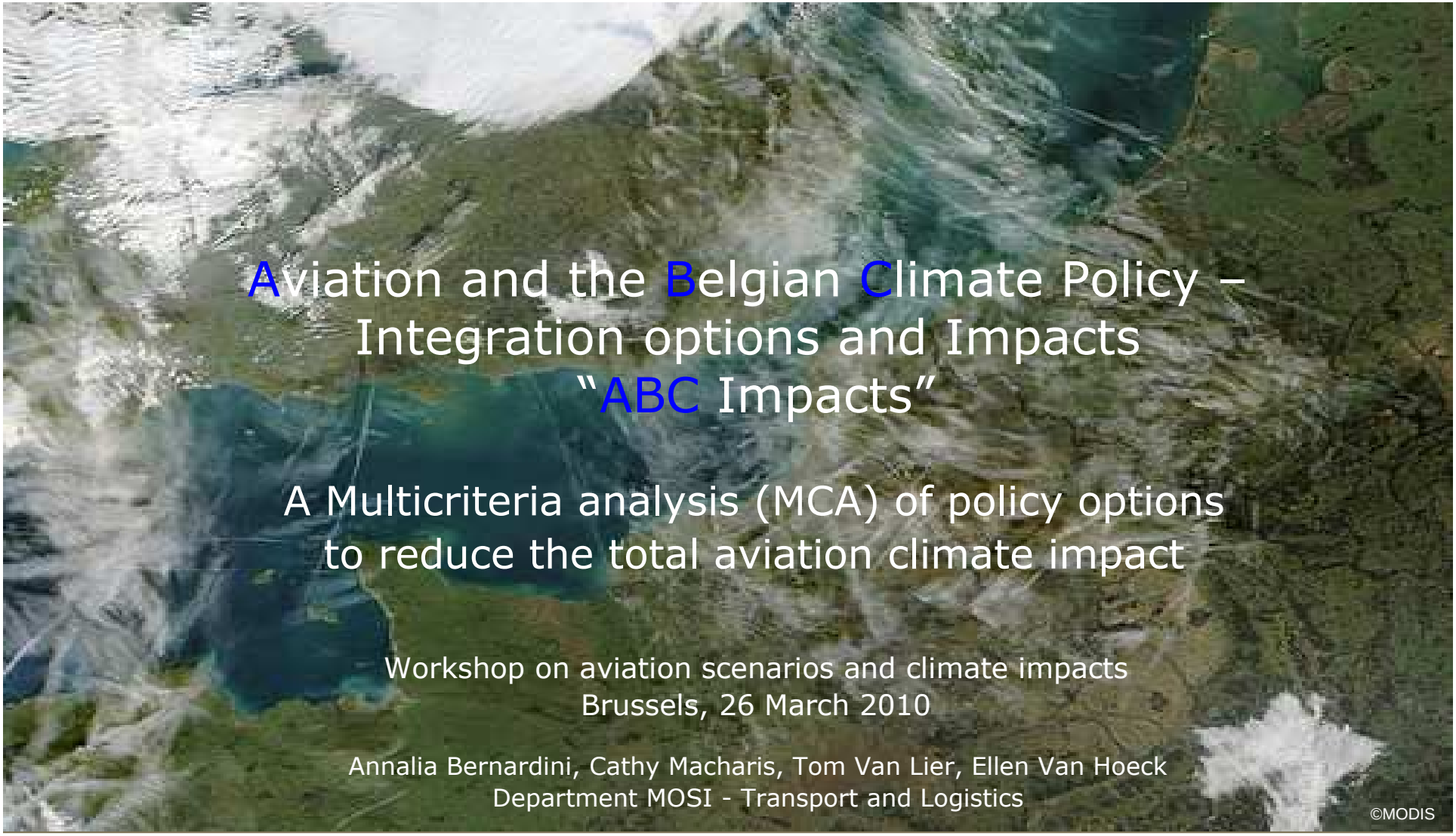

Aviation and the Belgian Climate Policy – Integration options and Impacts "ABC Impacts"

A Multicriteria analysis (MCA) of policy options to reduce the total aviation climate impact

Workshop on aviation scenarios and climate impacts
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Overview

1. The ABC project and MCA

2. MCA methods

2.1 Analytical Hierarchy Process (AHP)
2.2 PROMETHEE

3. PROMETHEE software applied to ABC project example

4. Conclusions and perspectives

1. The ABC project and MCA

ABC →

Policy options groups:

Technology R&D investments
Operational efficiencies/Infrastructures
Market based measures

MCA →

- Provides a framework to evaluate these climate policy options (alternatives) through a set of criteria:

Environmental performances
Achievements
Impacts advantages-benefits

- By applying the MCA, it is possible to some extent to outline an appropriate platform for future compromises

2. MCA methods

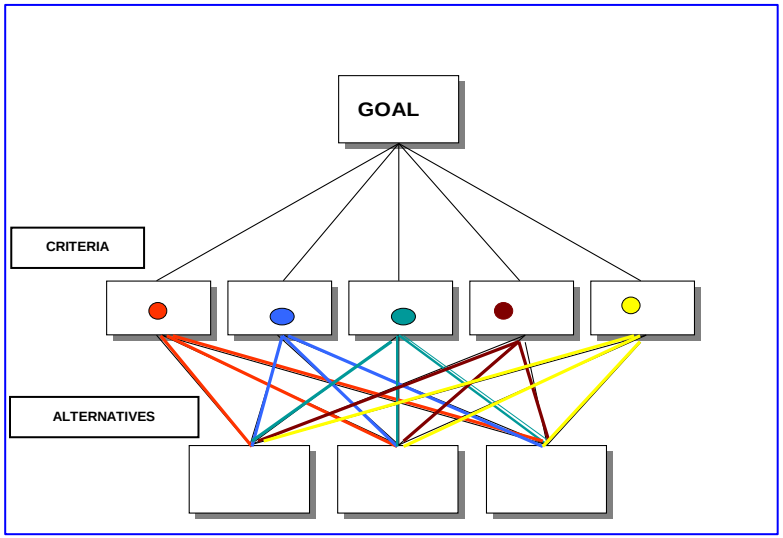
MCA →

- definition of the problems/goals to be achieved
- identification of the criteria
- prioritization of the alternatives

2. MCA methods

2.1 Analytical Hierarchy Process (AHP), developed by Prof. T. L. Saaty (1970)

AHP →



- hierarchy levels

based on pairwise comparisons:

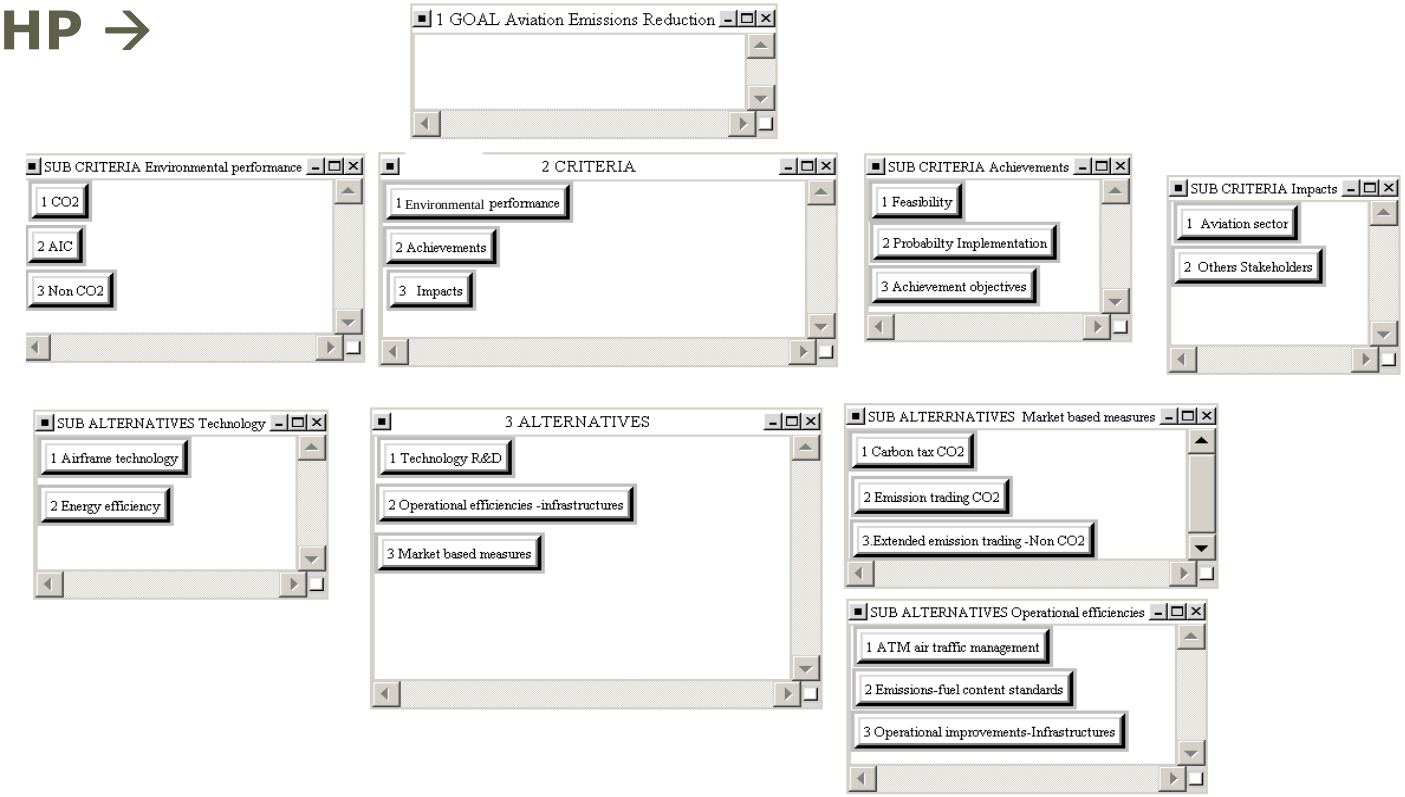
- between the goal and the criteria and sub-criteria
- between alternatives and criteria
- classification of the alternatives

2. MCA methods

2.1 Analytical Hierarchy Process (AHP), developed by Prof. T. L. Saaty (1970)

1. Goal 2. Criteria-Subcriteria 3. Alternatives-Subalternatives

ABC-AHP →



With AHP, the user is forced to perform a high number of comparisons: n(n-1)/2

2.MCA methods

2.2 PROMETHEE & GAIA, developed by Prof. J.P. Brans and Prof. B. Mareschal at the (U.L.B. and V.U.B., 1983), Prof. C. Macharis, Prof. J.P. Brans and Prof. B. Mareschal, PROMETHEE GDSS, (1998)

	$f_1(.)$	$f_2(.)$	……	$f_j(.)$	……	$f_k(.)$
a_1						
a_2						
…						
a_i				$f_j(a_i)$		
…						
a_n						

PROMETHEE →

- allows the user to directly exploit the data (alternatives a_n, criteria f_k) of the problem in a simple evolutive multicriteria table (Performance Matrix)

- extensive sensitivity analyses as well as visual representations (GAIA) of the data are available to the decision-maker

- particularly userfriendly software, used for the ABC Impacts policy options assessment

3. PROMETHEE software applied to ABC project

« *made with D-Sight* »

Goal

Policy options to reduce the total aviation climate impact

Alternatives

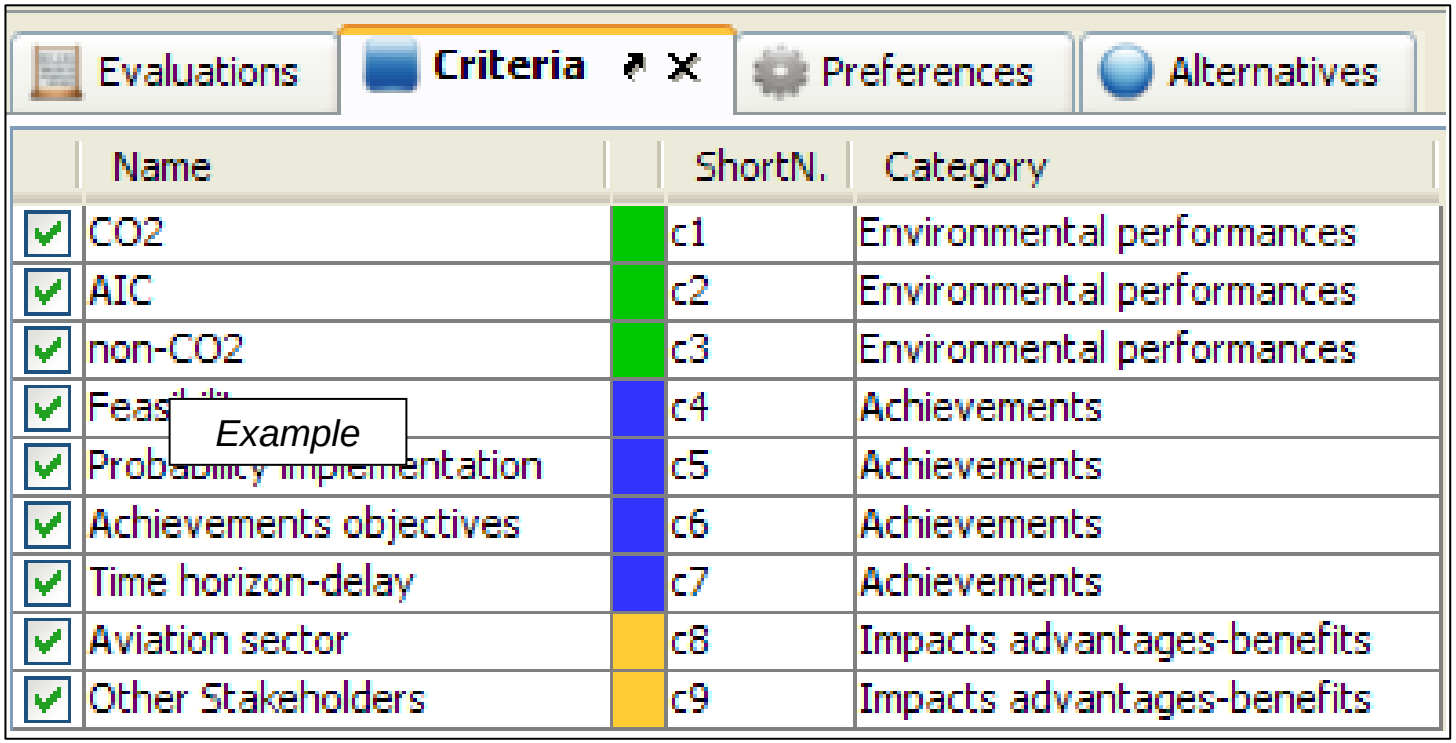
Alternatives

	Name		ShortN.	Group
☑	Airframe technology (engines, materials, design)		a1	Technology R&D investments
☑	Energy effi…ative fuels)		a2	Technology R&D investments
☑	Air Traffic M…		a3	Operational efficiencies/Infrastructure
☑	Emission/fuel content standard		a4	Operational efficiencies/Infrastructure
☑	Operational improvements/Infrastructure		a5	Operational efficiencies/Infrastructure
☑	Fuel tax (CO2)		a6	Market based measures
☑	Emission Trading (and similar mechanism)		a7	Market based measures
☑	Extended Emission Trading (non-CO2)		a8	Market based measures

Example

3. PROMETHEE software applied to ABC project

Criteria



Name	ShortN.	Category
CO2	c1	Environmental performances
AIC	c2	Environmental performances
non-CO2	c3	Environmental performances
Feas	c4	Achievements
Probability implementation	c5	Achievements
Achievements objectives	c6	Achievements
Time horizon-delay	c7	Achievements
Aviation sector	c8	Impacts advantages-benefits
Other Stakeholders	c9	Impacts advantages-benefits

Example

3. PROMETHEE software applied to ABC project

Performance Matrix

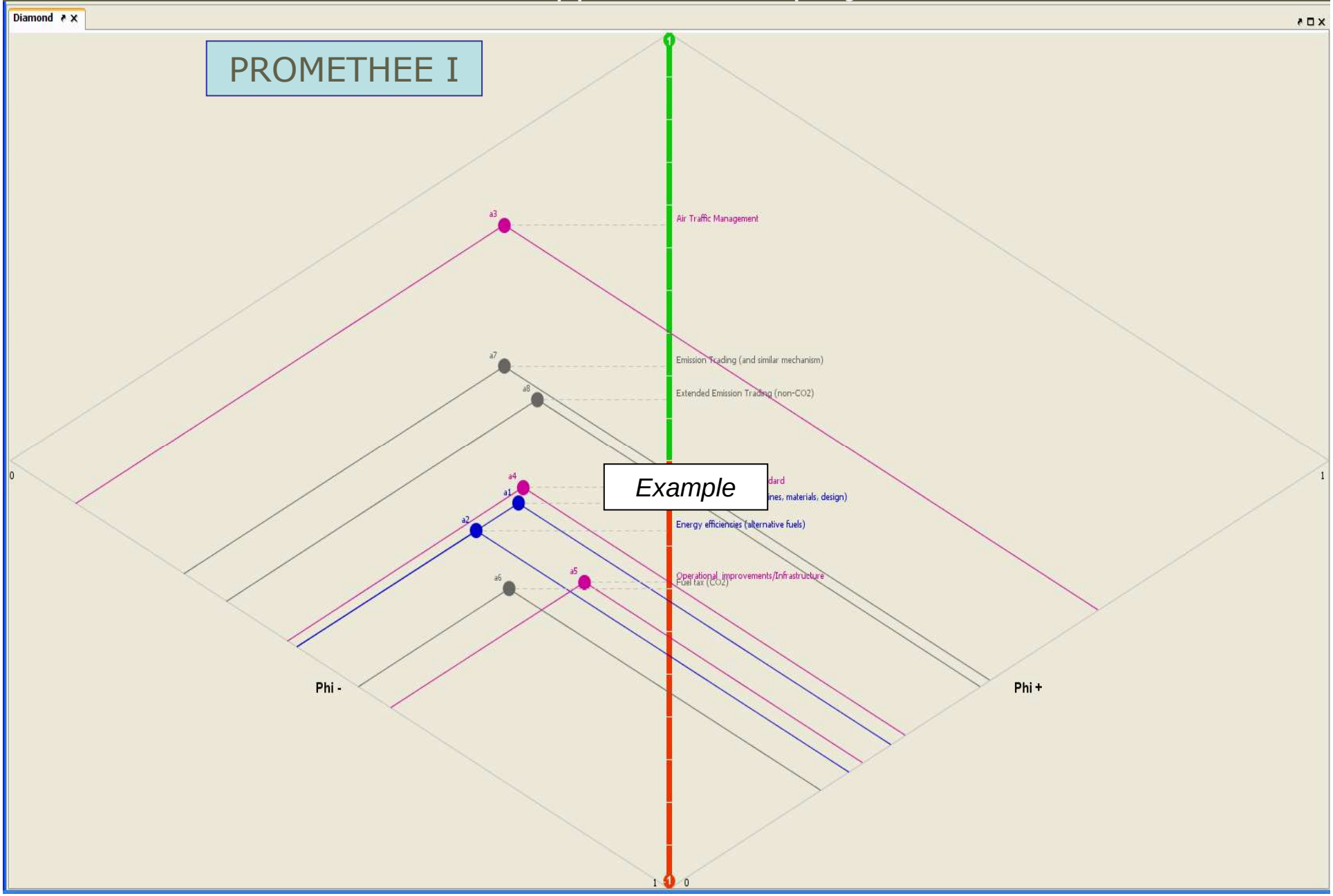
Qualitative Scores	Efficiency
1	Little efficient
2	Moderately efficient
3	Satisfactory
4	More than satisfactory
5	Very efficient

Evaluations

	CO2	AIC	non-CO2	Feasibility	Probability implementation	Achievements objectives	Time horizon-delay	Aviation sector	Other Stakeholders
Airframe technology (engines, materials, design)	Satisfactory	Little efficient	Satisfactory	More than satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Energy efficiencies (alternative fuels)	More than satisfactory	Satisfactory	Moderately efficient	Satisfactory	More than satisfactory	Moderately efficient	Satisfactory	Moderately efficient	Moderately efficient
Air Traffic Management	More than satisfactory	More than satisfactory	More than satisfactory		More than satisfactory	Satisfactory	More than satisfactory	More than satisfactory	Moderately efficient
Emission/fuel content standard	Little efficient	More than satisfactory	Satisfactory		Very efficient	Moderately efficient	Satisfactory	Moderately efficient	Satisfactory
Operational improvements/Infrastructure	Moderately efficient	Little efficient	Little efficient		re than satisfactory	Moderately efficient	More than satisfactory	Satisfactory	Satisfactory
Fuel tax (CO2)	Satisfactory	Moderately efficient	Moderately efficient	More than satisfactory	Moderately efficient	Satisfactory	Satisfactory	Little efficient	Satisfactory
Emission Trading (and similar mechanism)	More than satisfactory	Moderately efficient	Moderately efficient	More than satisfactory	Very efficient	More than satisfactory	Very efficient	Moderately efficient	Moderately efficient
Extended Emission Trading (non-CO2)	More than satisfactory	More than satisfactory	More than satisfactory	Satisfactory	Satisfactory	Very efficient	Moderately efficient	Little efficient	Moderately efficient

Example

3. PROMETHEE software applied to ABC project



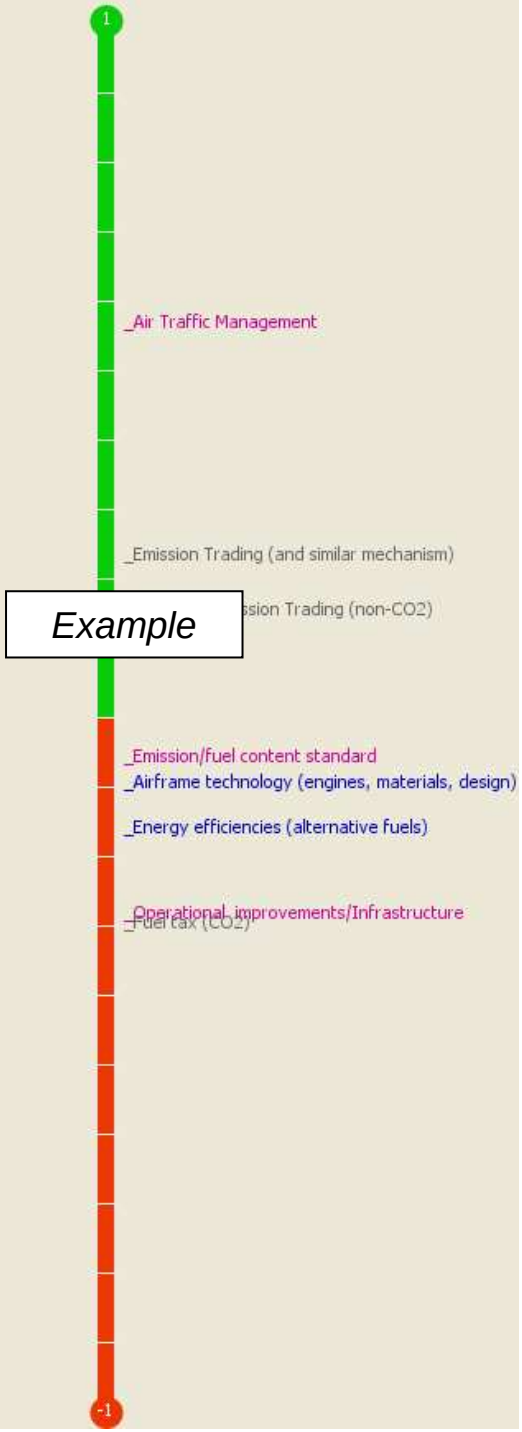
3. PROMETHEE software applied to ABC project

PROMETHEE II

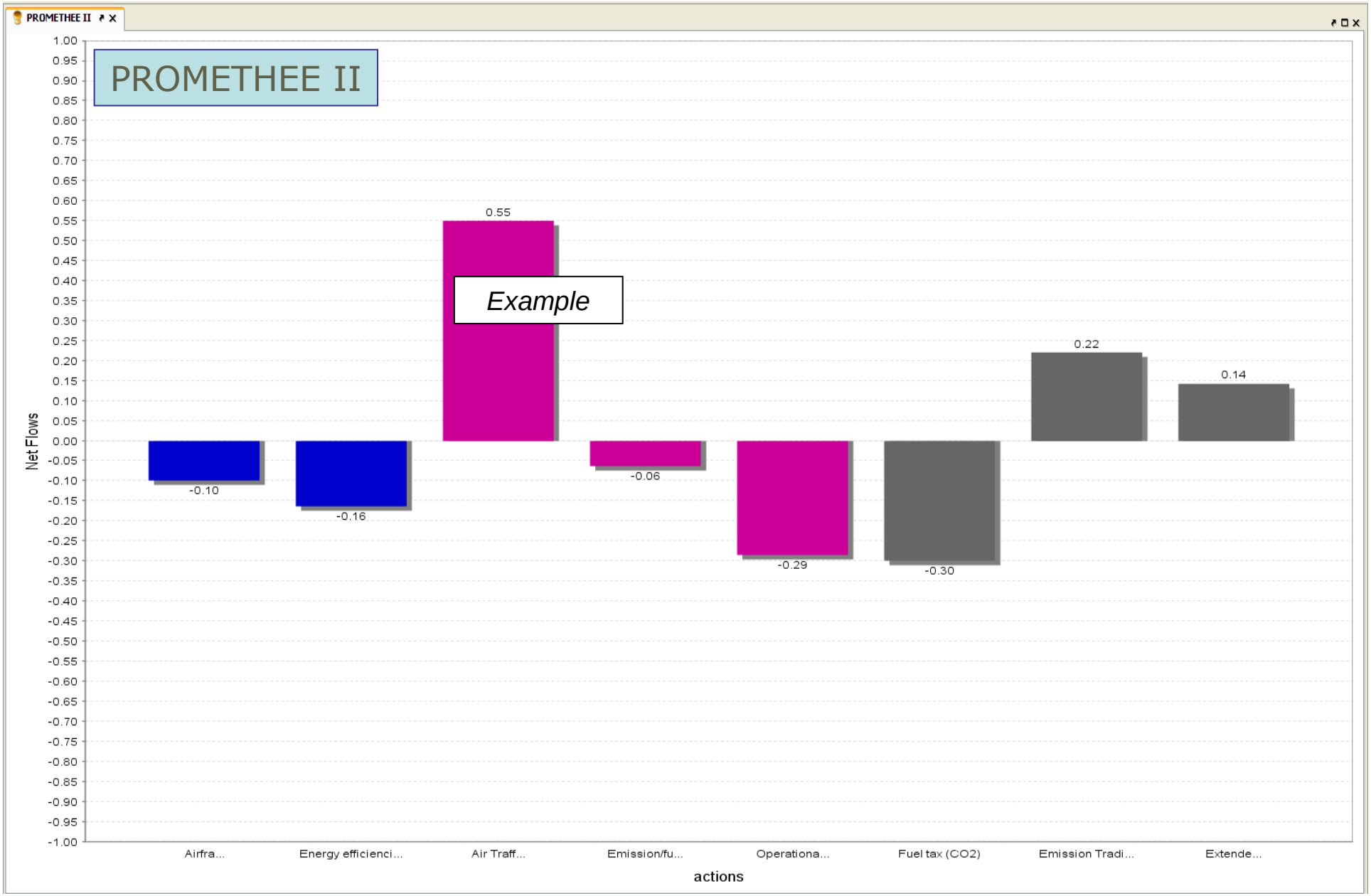
Alternatives

	Name		ShortN.	Group
☑	Air Traffic Management		a3	Operational efficiencies/Infrastructure
☑	Emission Trading (and similar mechanism)		a7	Market based measures
☑	Extended Emission Trading (non-CO2)		a8	Market based measures
☑	Emission/fuel cont		a4	Operational efficiencies/Infrastructure
☑	Airframe technolo		a1	Technology R&D investments
☑	Energy efficiencies (alternative fuels)		a2	Technology R&D investments
☑	Operational improvements/Infrastructure		a5	Operational efficiencies/Infrastructure
☑	Fuel tax (CO2)		a6	Market based measures

Example



3. PROMETHEE software applied to ABC project



3. PROMETHEE software applied to ABC project

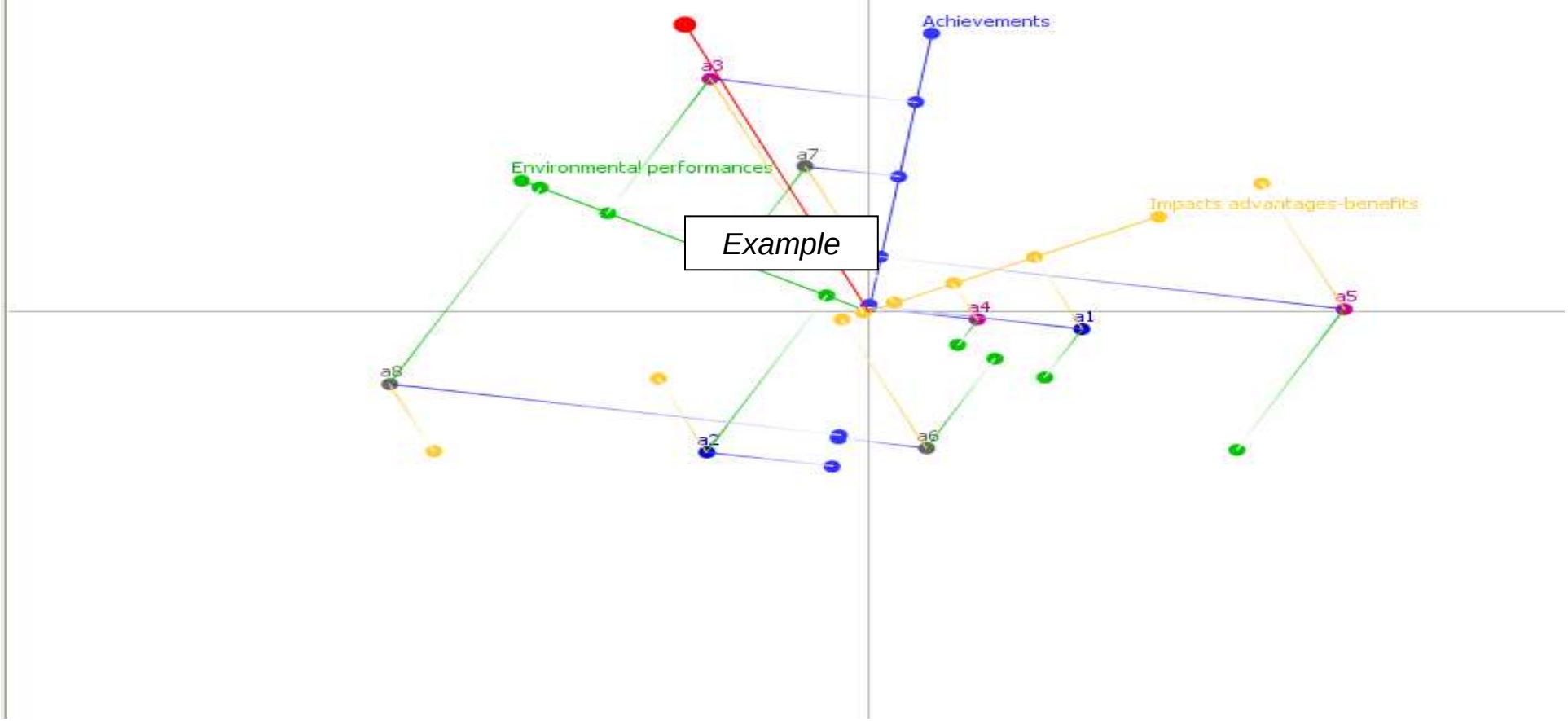
Gaia

zoom=100%

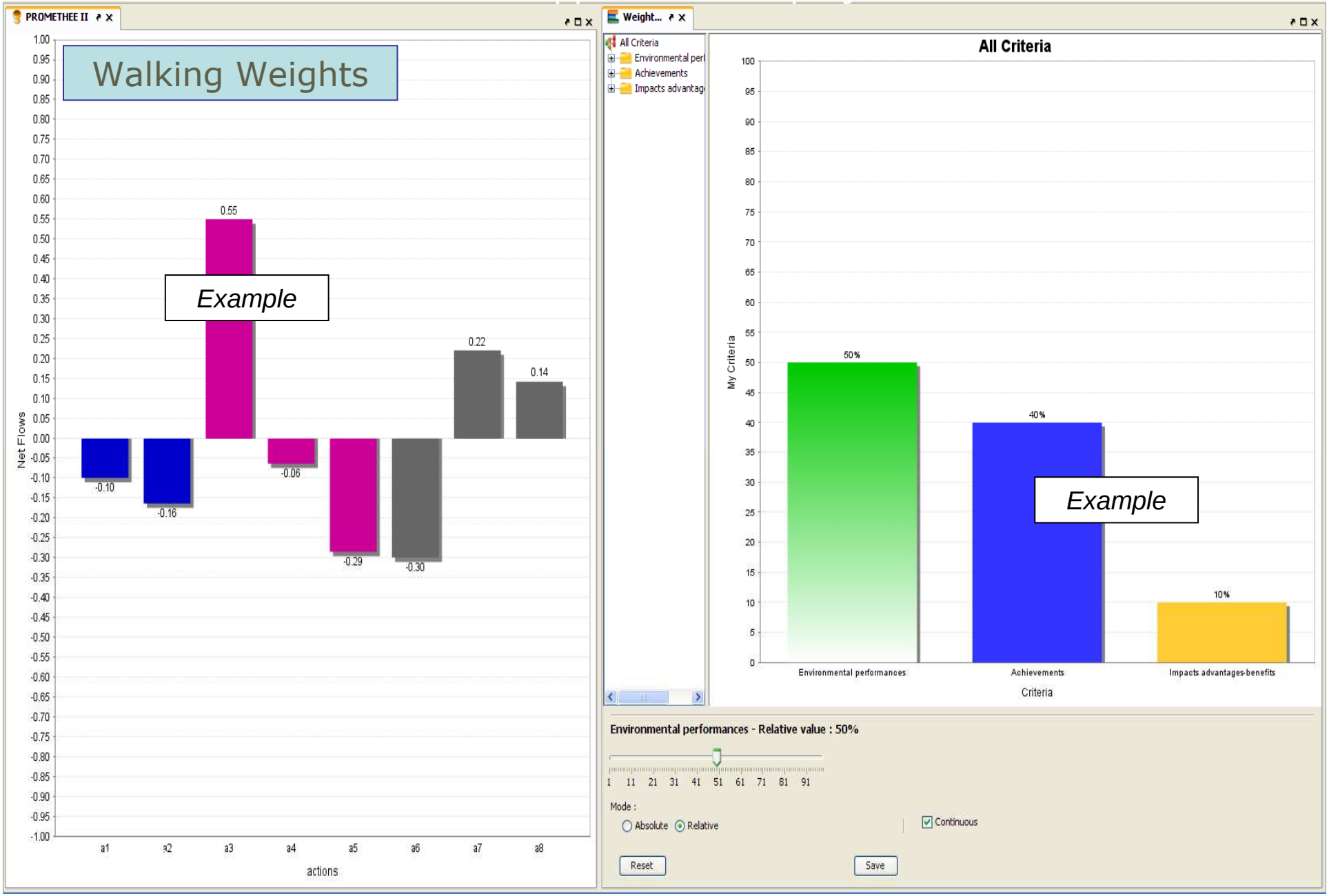
GAIA

Alternatives

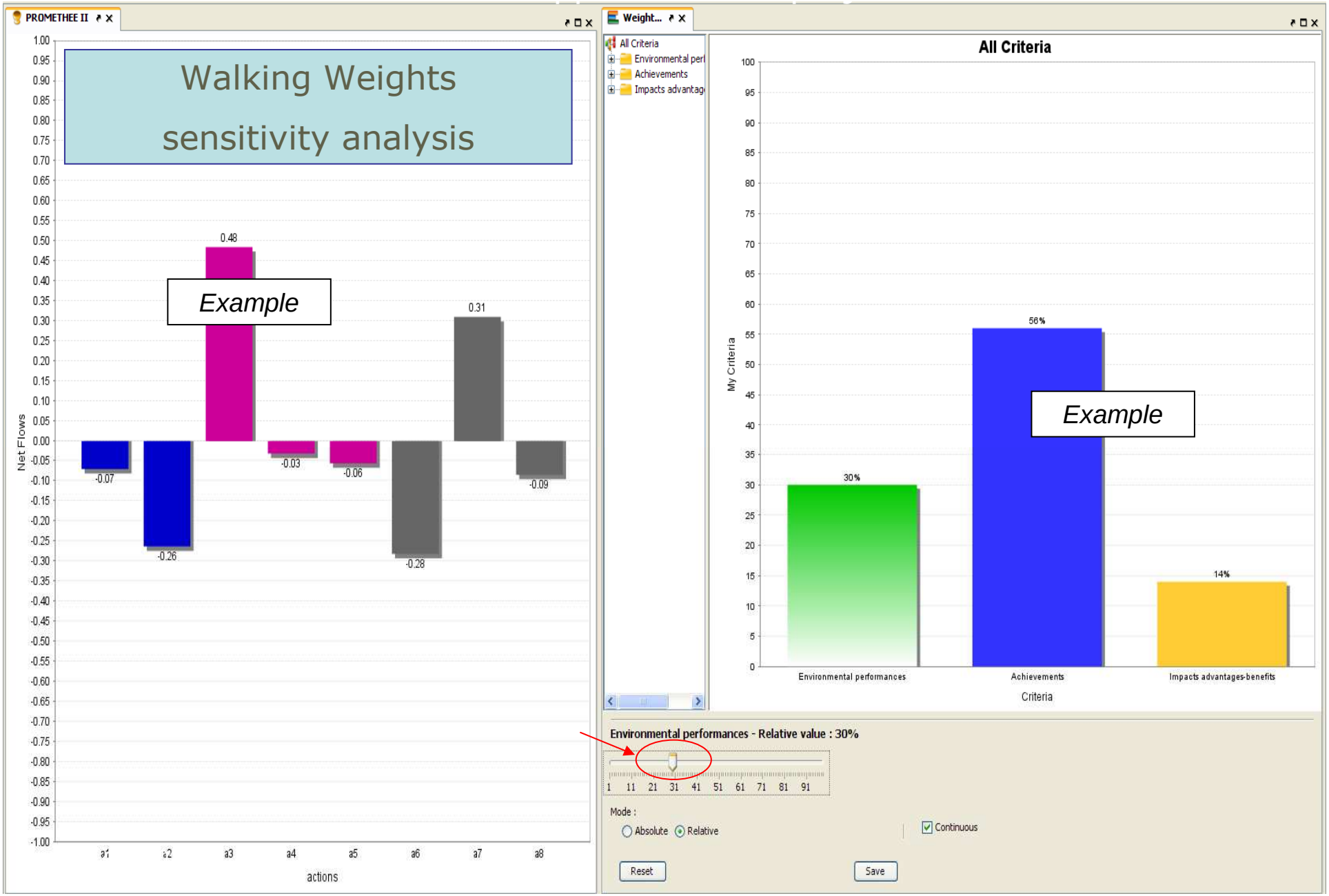
Name	ShortN.	Group
Air Traffic Management	a3	Operational efficiencies/Infrastructure
Emission Trading (and similar mechanism)	a7	Market based measures
Extended Emission Trading (non-CO2)	a8	Market based measures
Emission/fuel content standard	a4	Operational efficiencies/Infrastructure
Airframe technology (engines, materials, design)	a1	Technology R&D investments
Energy efficiencies (alternative fuels)	a2	Technology R&D investments
Operational improvements/Infrastructure	a5	Operational efficiencies/Infrastructure
Fuel tax (CO2)	a6	Market based measures



3. PROMETHEE software applied to ABC project



3. PROMETHEE software applied to ABC project



4. Conclusions and perspectives

PROMETHEE outcome → top five alternatives assessment

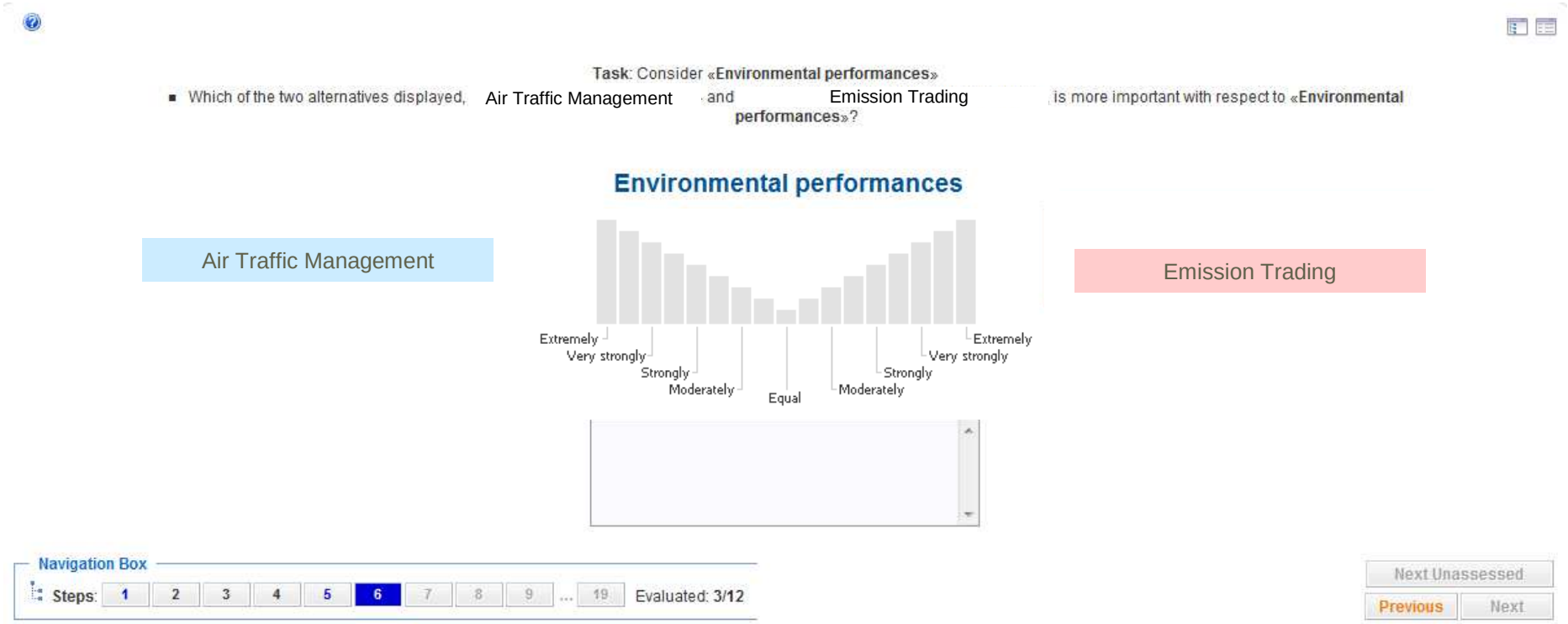
Stakeholders opinions:

- The stakeholders can provide feedback by indicating their assessments
- Provide weights for criteria (PROMETHEE)
- AHP online stakeholders evaluation
- PROMETHEE online stakeholders evaluation (in progress)

4. Conclusions and perspectives

AHP online stakeholders assessment

Decision making online software based on AHP



Thank you for your attention

"Our present day values come from the past. But we need others that come from a simulated future into which we are marching even now. We need ways to forecast that future to improve our actions today compatible with whatever values we have."

Thomas L. Saaty

Pictures taken by A. Bernardini, Belgium (2010)