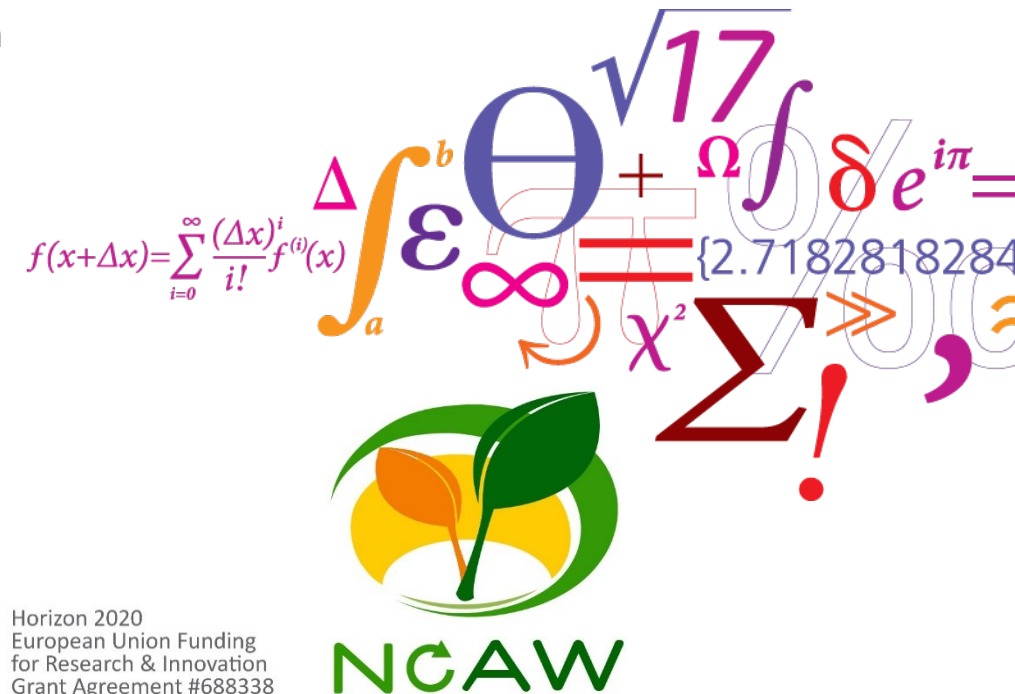


Incorporating Relative Importance

selecting a polyphenol production method for agro-waste treatment in an environmental and economic multi-criteria decision making context

By: Joshua Sohn, Giovanna Croxatto Vega, Morten Birkved, Stig Irving Olsen

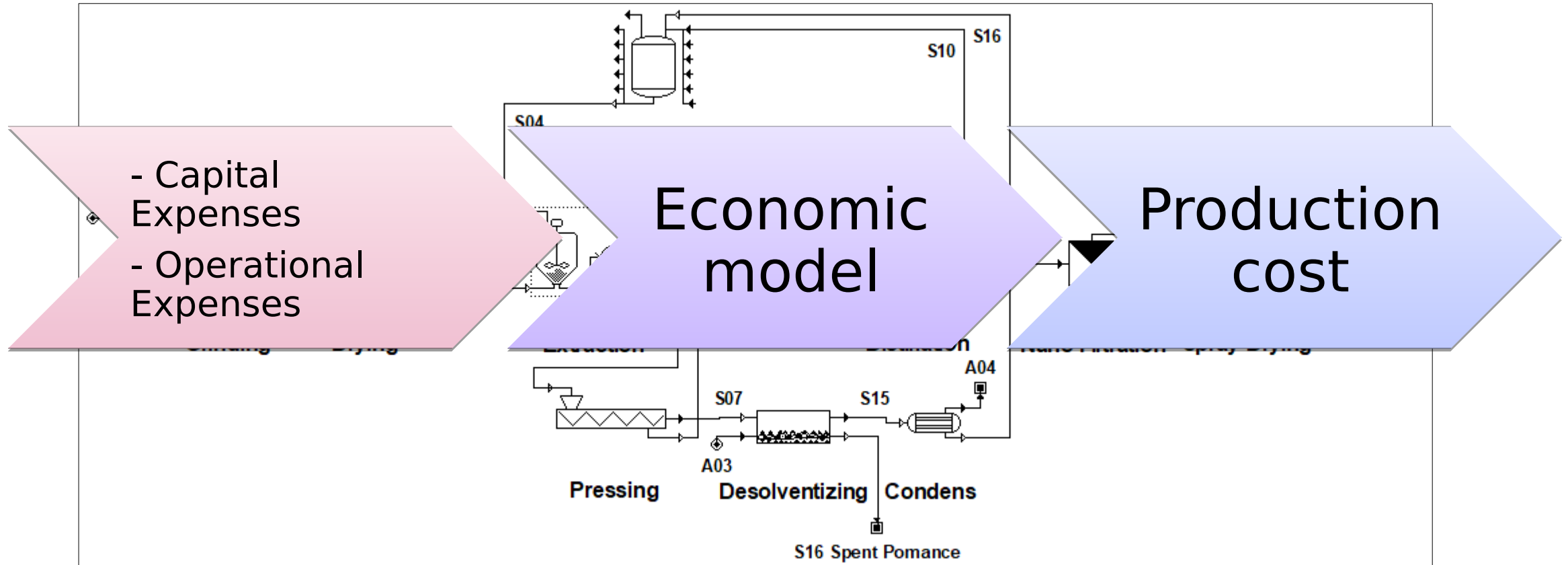
Presented by: Joshua Sohn



Overview

- Introduction to TEA and LCA
- Introduction to MCDA
- Application in the assessment of polyphenol extraction technologies

Techno-Economic Assessment - Introduction



Life Cycle Assessment - Introduction

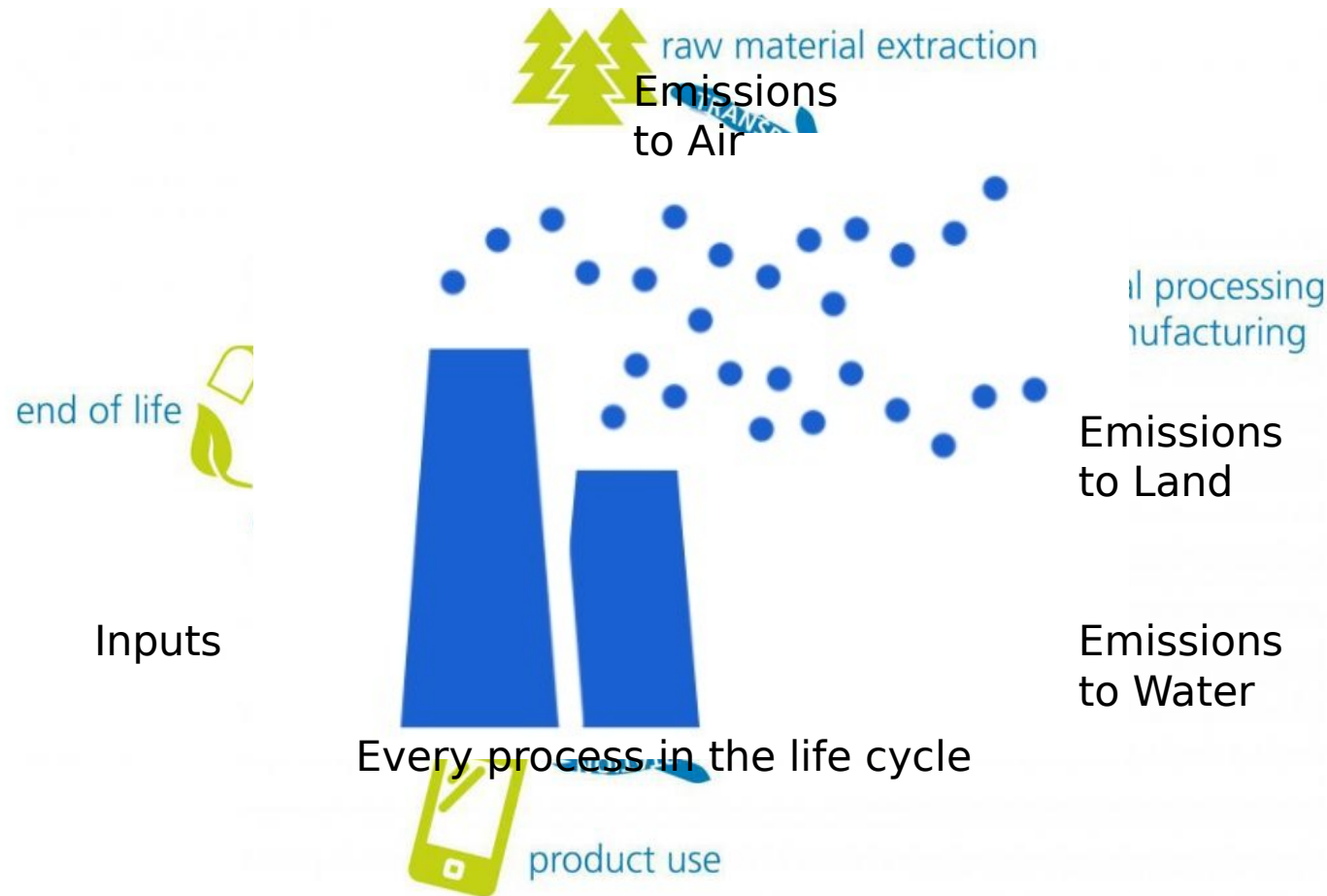
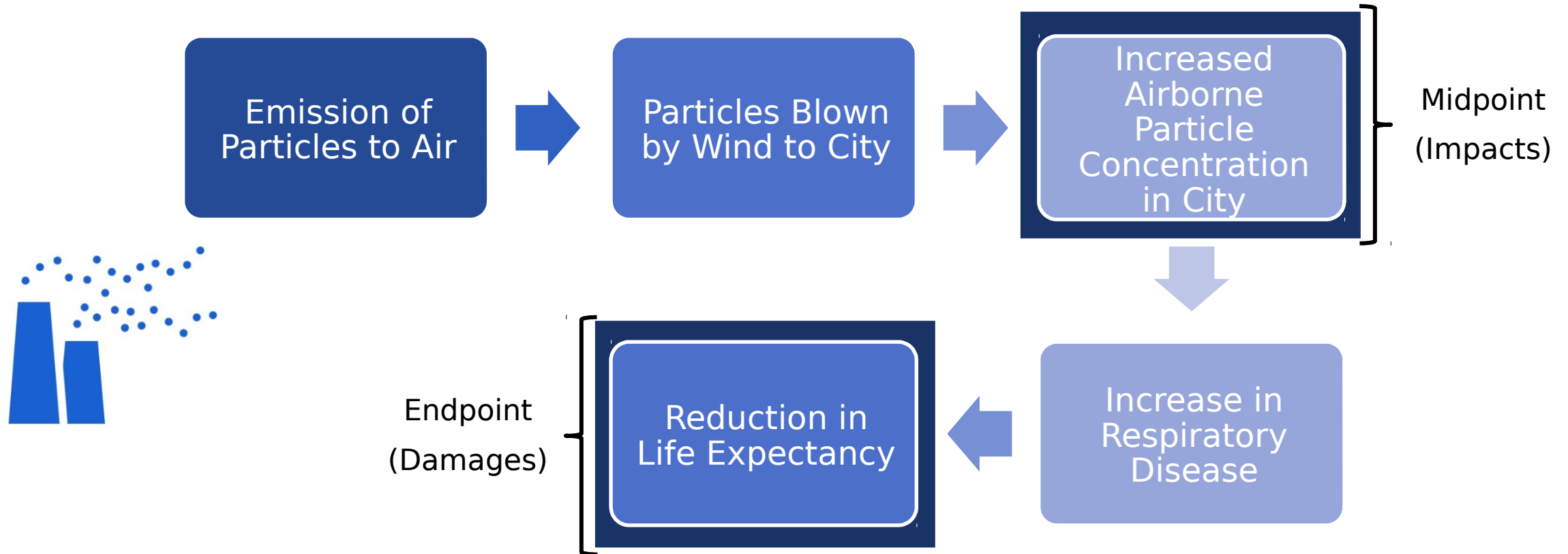


Photo: www.agc-glass.eu

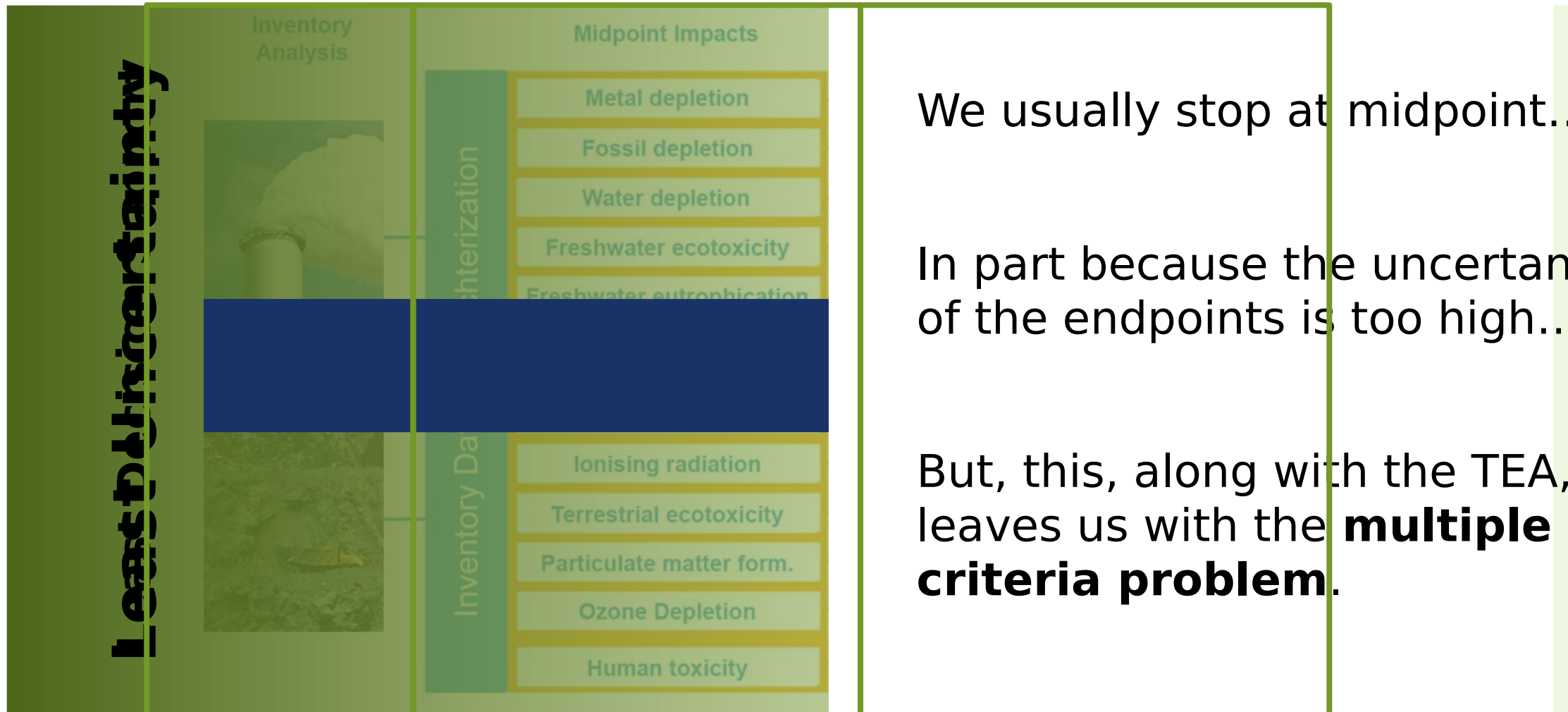
Life Cycle Assessment - Introduction

Emissions: The Cause and Effect Chain



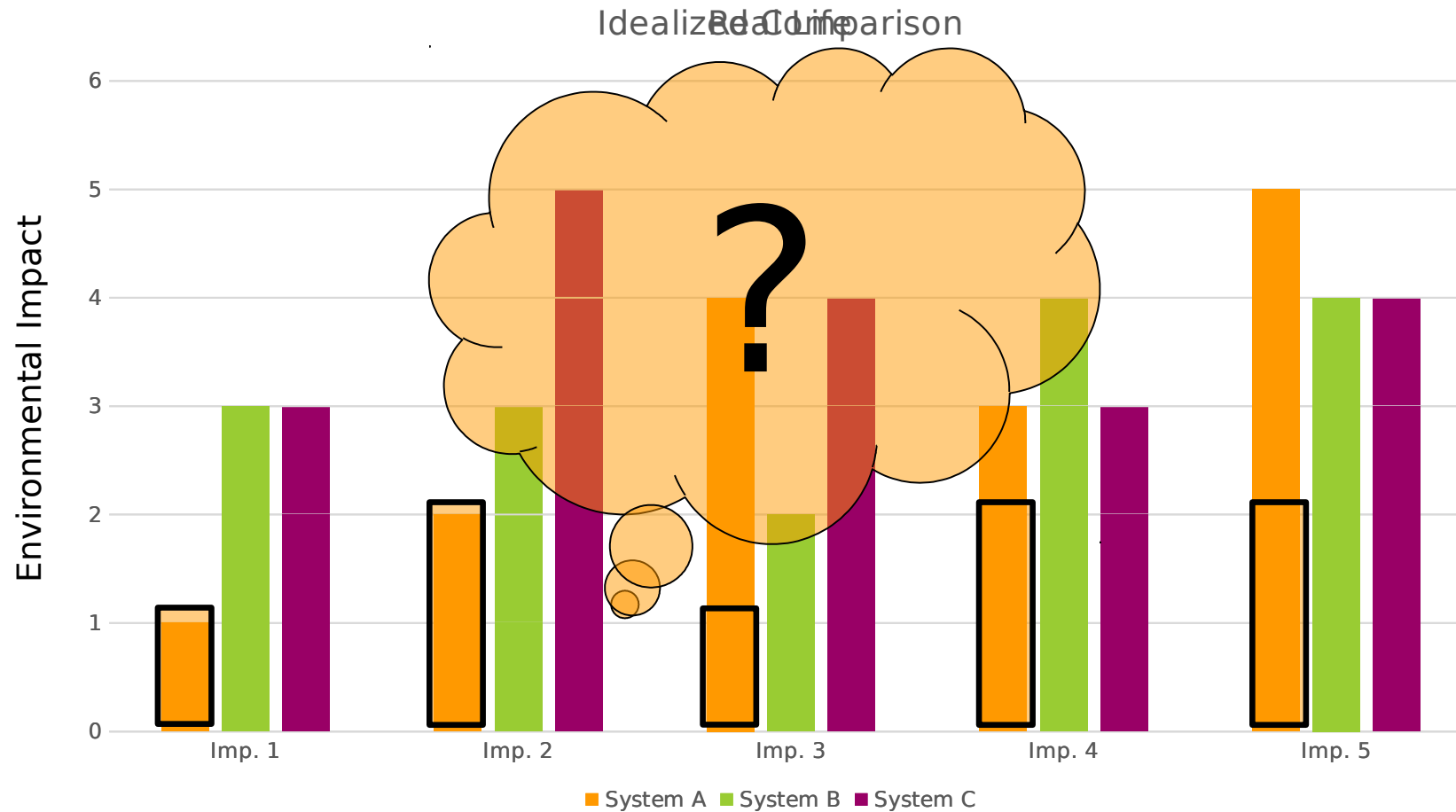
Life Cycle Assessment - Introduction

The Uncertainty Trade-Off

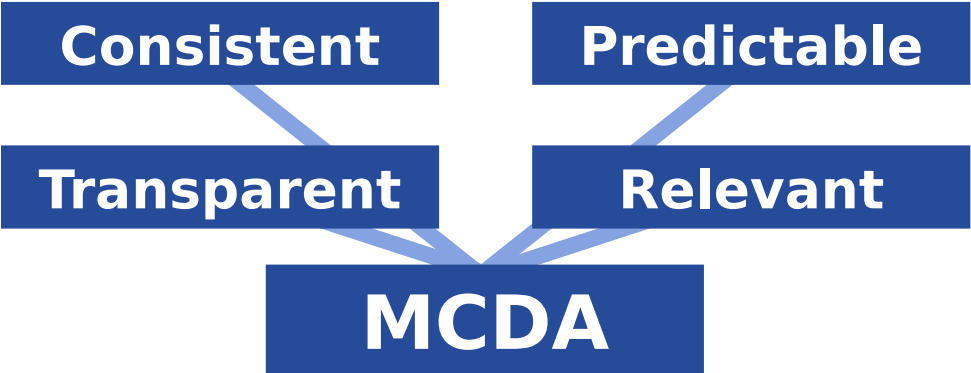
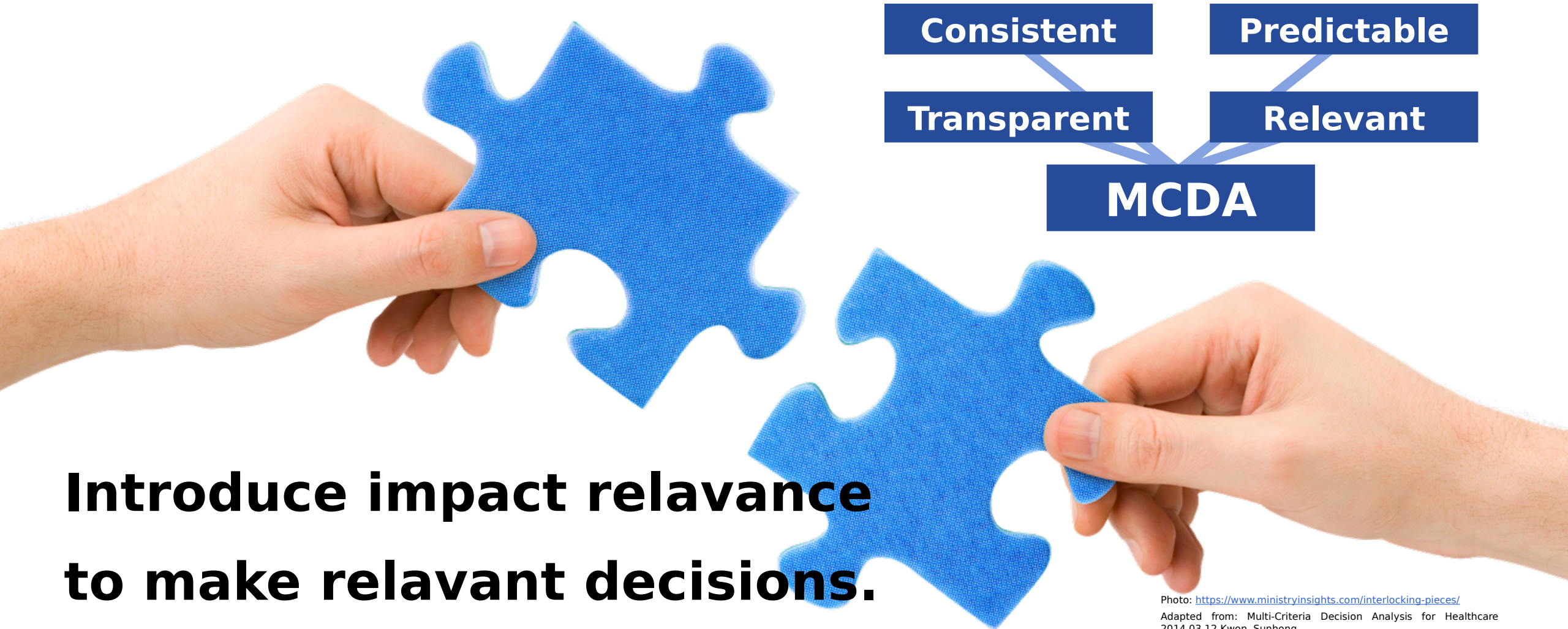


Life Cycle Assessment - Introduction

The multiple Criteria Problem



Multiple-Criteria Decision Assessment (MCDA)

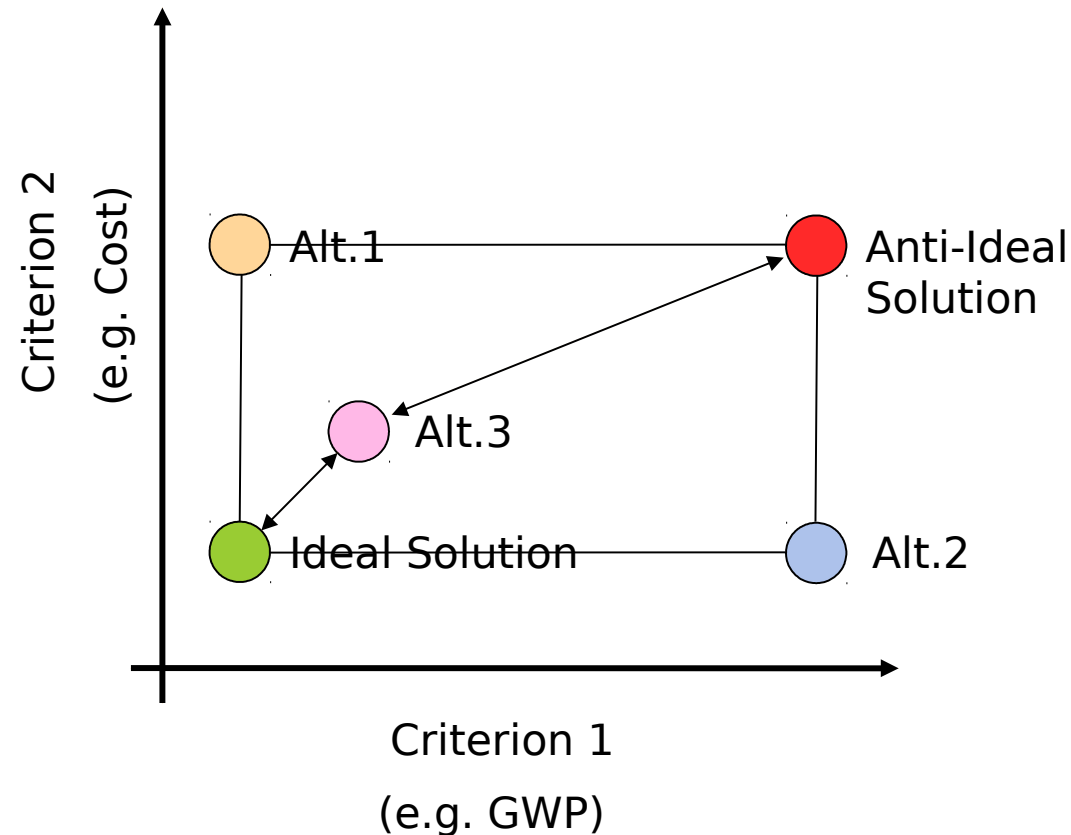


**Introduce impact relevance
to make relevant decisions.**

Photo: <https://www.ministryinsights.com/interlocking-pieces/>
Adapted from: Multi-Criteria Decision Analysis for Healthcare
2014.03.12 Kwon, Sunhong

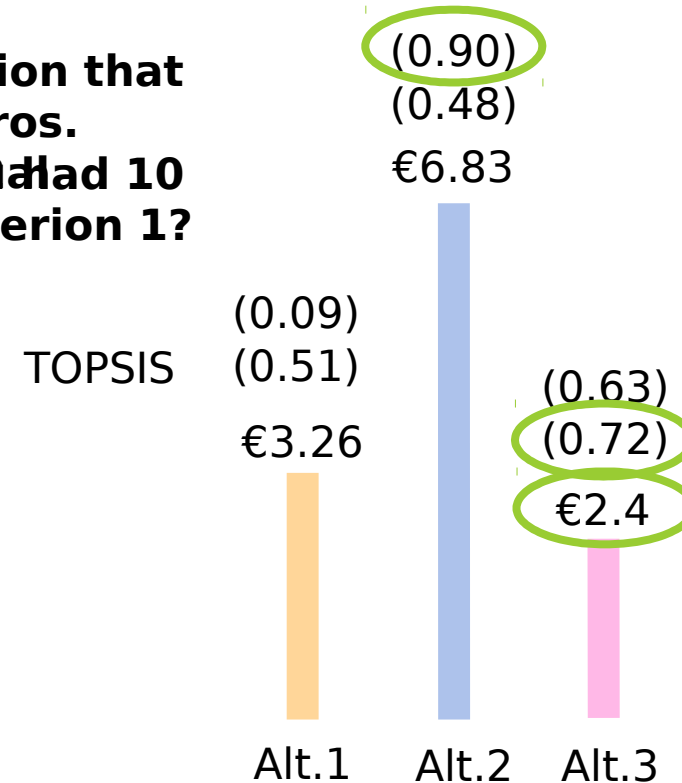
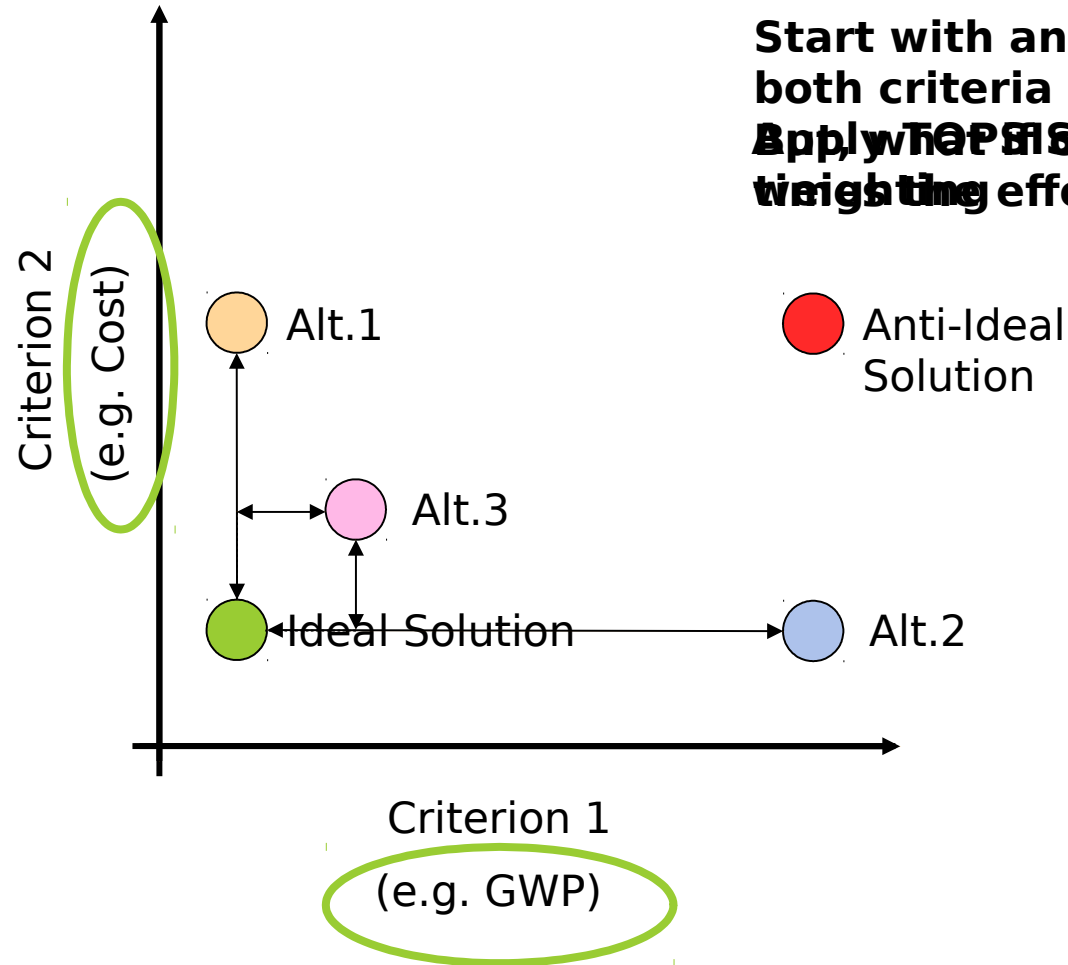
Introduction to MCDA: TOPSIS

The Technique for Order of Preference by Similarity to Ideal Solution



- **Measures idealness:** minimizing the Euclidean distance to the ideal solution and maximizing Euclidean distance to the anti-ideal solution
- **Compensatory:** good performance in one criteria can compensate for poor performance in another

Introduction to MCDA: TOPSIS

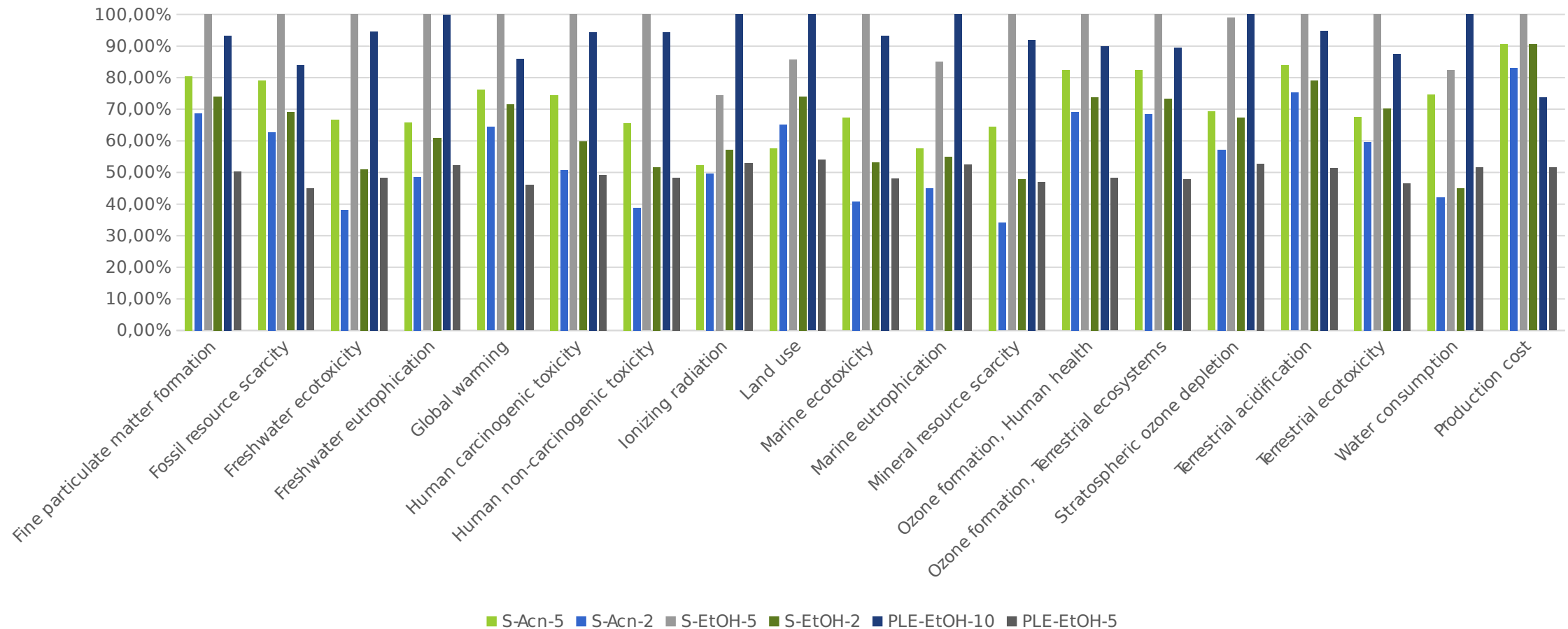


MCDA - Criteria Weighting

- In order to correlate the multiple criteria, a **weighting profile** is introduced to **relate the importance** of each of the criteria with respect to the others
 - Personal/constituent values
 - Scientific consensus/modelling
 - Performance demands/thresholds
 - Etc.

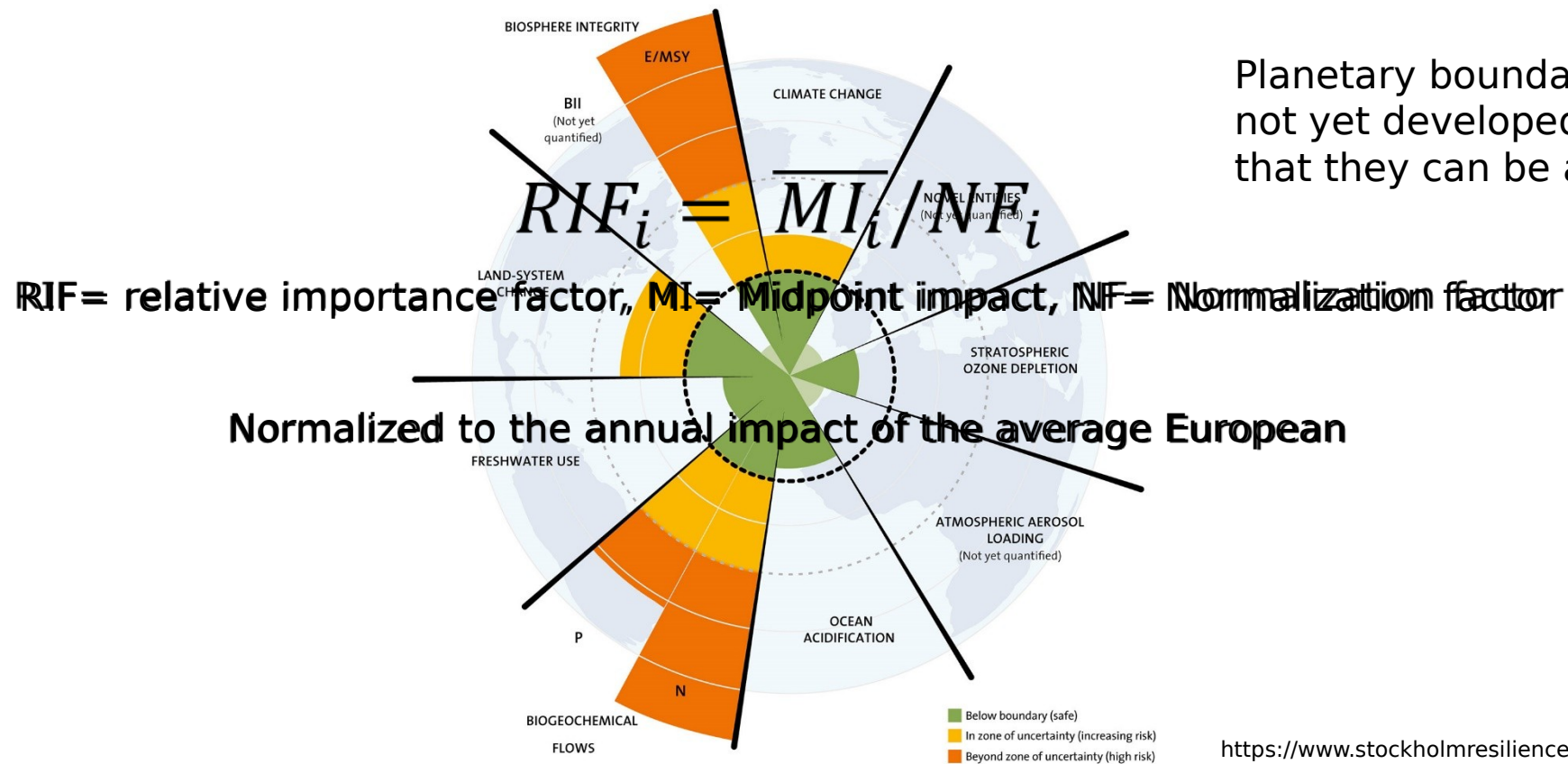
MCDA Application to Polyphenol Extraction

Internally Normalized Impacts



MCDA Application: weighting

- Developed using relationship of environmental impacts to the emissions of an average european



Planetary boundaries are not yet developed such that they can be applied.

<https://www.stockholmresilience.org/research/planetary-boundaries.html>

MCDA Application: weighting

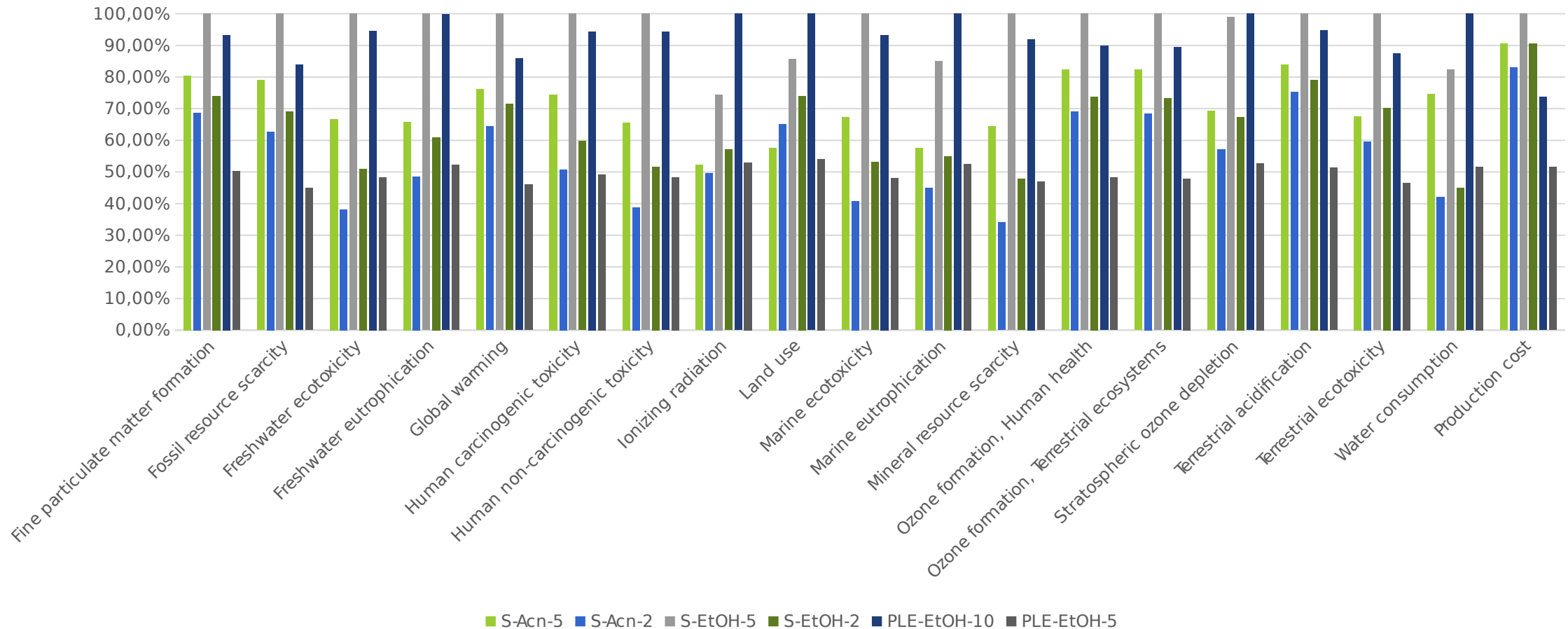
- Developed using relationship of environmental impacts to the emissions of an average european

Fine particulate matter formation	Fossil resource scarcity	Freshwater ecotoxicity	Freshwater eutrophication	Global warming	Human carcinogenic toxicity	Human non-carcinogenic toxicity	Ionizing radiation	Land use	Marine ecotoxicity	Marine eutrophication	Mineral resource scarcity	Ozone formation, Human health	Ozone formation, Terrestrial ecosystems	Stratospheric ozone depletion	Terrestrial acidification	Terrestrial ecotoxicity	Water consumption
12.83	276.36	183.72	86.75	58.98	59.26	3.93	28.40	0.61	161.97	0.86	0.004	23.98	28.77	2.05	21.34	42.57	7.62

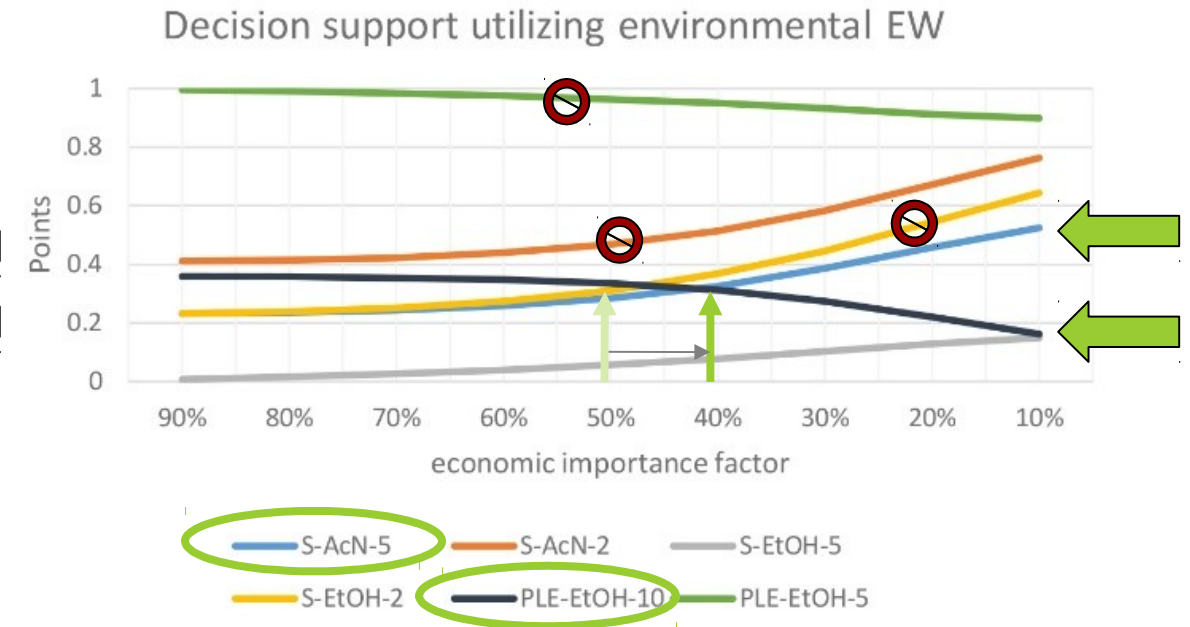
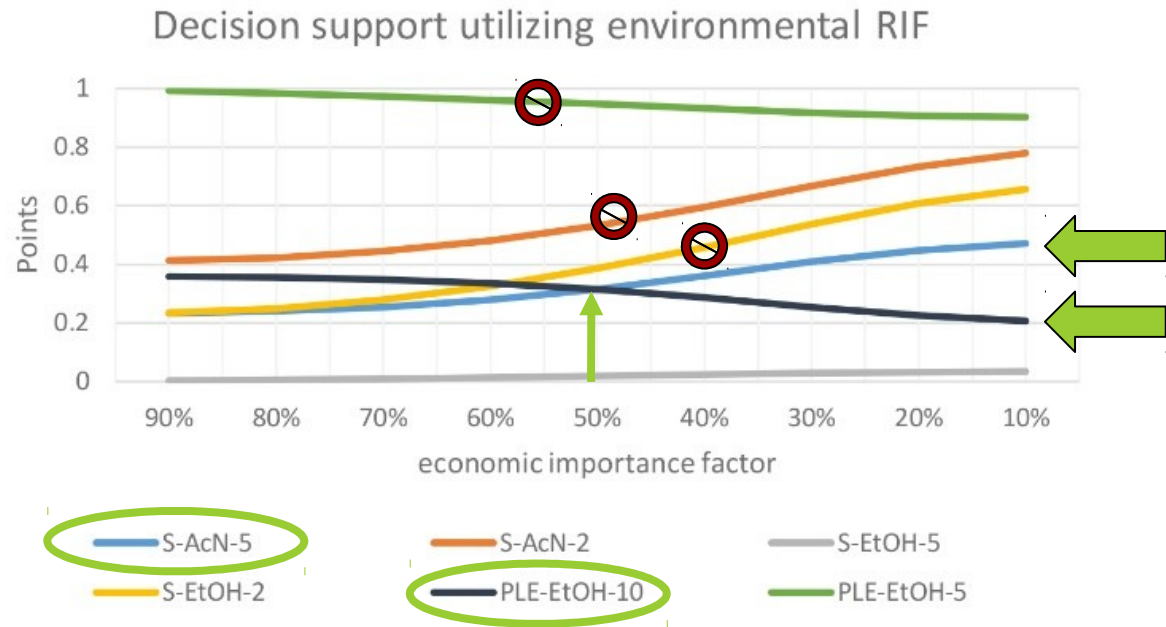
Important	Unimportant
Fossil Resource Scarcity (276)	Mineral Resource Scarcity (0.004)
Freshwater Ecotoxicity (183)	Land Use (0.6)
Marine Ecotoxicity (161)	Marine Eutrophication (0.9)
Freshwater Eutrophication (86)	Stratospheric Ozone Depletion (2.0)
Human Carcinogenic Toxicity (59)	Human Non-Carcinogenic Toxicity (3.9)
Global Warming (59)	Water Consumption (7.6)

MCDA Application to Polyphenol Extraction

Internally Normalized Impacts



MCDA Application to Polyphenol Extraction: Conclusions



Introducing MCDA allows for transparent delivery of decision important criteria

Questions?



European
Commission

Horizon 2020
European Union Funding
for Research & Innovation
Grant Agreement #688338



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