Evaluation and Decision Process for Greener Asphalt Roads

Period: 15/04/2014 -14/04/2016 (2 year)

Call 2013:
Energy Efficiency: Materials and Technologies

(funded by Austria, Germany, the Netherlands, Norway, Slovenia, UK)

End of program Workshop
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CEDR
Conférence Européenne des Directeurs des Routes
Conference of European Directors of Roads

Project Consortium

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“green” asphalt

Any bituminous mixture produced by using specific **materials** and/or **technologies** with the aim of reducing the environmental impact

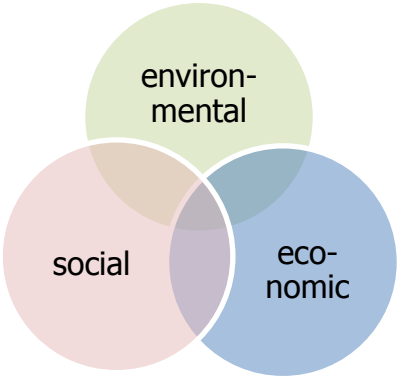
Overview of "green" bituminous materials and technologies

Warm mix asphalt	Foaming techniques Techniques using organic additives Techniques using chemical additives
Cold /semi-cold asphalt technologies	Emulsion based techniques Foam based techniques
Asphalt recycling	Plant recycling In situ recycling
Secondary materials	Steel slag Fly ash Crumb rubber Shredded roofing Crushed glass
Modified and Alternative binders	Vegetal or bio-binders Sulphur modified/extended bitumen Polymer modified bitumen
Additives	Anti-stripping agents Pigments for coloured asphalt Fibres Rejuvenators

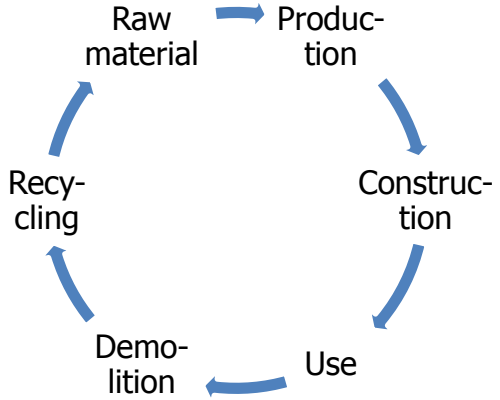
Project aim

Develop a methodology to assist **NRAs** in the **sustainability evaluation** of **bituminous materials/technologies** and in the **decision process** to use it on their network

Considering the 3 facets of sustainability



Considering all life cycle stages of a bituminous pavement



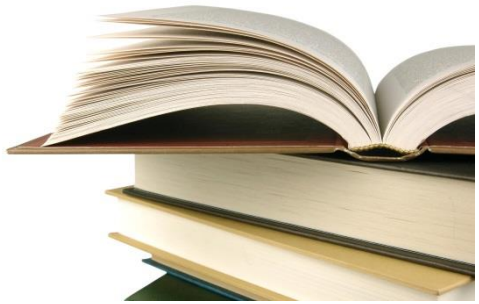
Objectives

1. Collect and summarize available information on sustainability aspects of new materials and technologies used in "green" bituminous mixtures
2. Propose a quick and qualitative system for the assessment of the recyclability of "green" asphalt
3. Select the relevant sustainability indicators for "green" bituminous mixtures
4. Select the best tools for the evaluation of the different sustainability indicators
5. Provide a methodology, built on the selected tools, for assessing alternative materials/technologies and to evaluate the overall sustainability
6. Demonstrate this methodology for a few selected test cases

Where EDGAR goes further…

Objectives (1)

1. Collect and summarize available information on sustainability aspects of new materials and technologies used in "green bituminous mixtures"



Outcome (1)

- Review based on literature, projects and expertise of project team , with focus on "**alerts**" and "**knowledge gaps**"

  ⇨ Deliverable D1.1 - Energy efficient materials and technologies and their impact on sustainability

  Main conclusions from D1.1:

  - Data on sustainability issues often limited to a few life cycle stages
  - System boundaries not always well defined
  - Information missing for many sustainability indicators

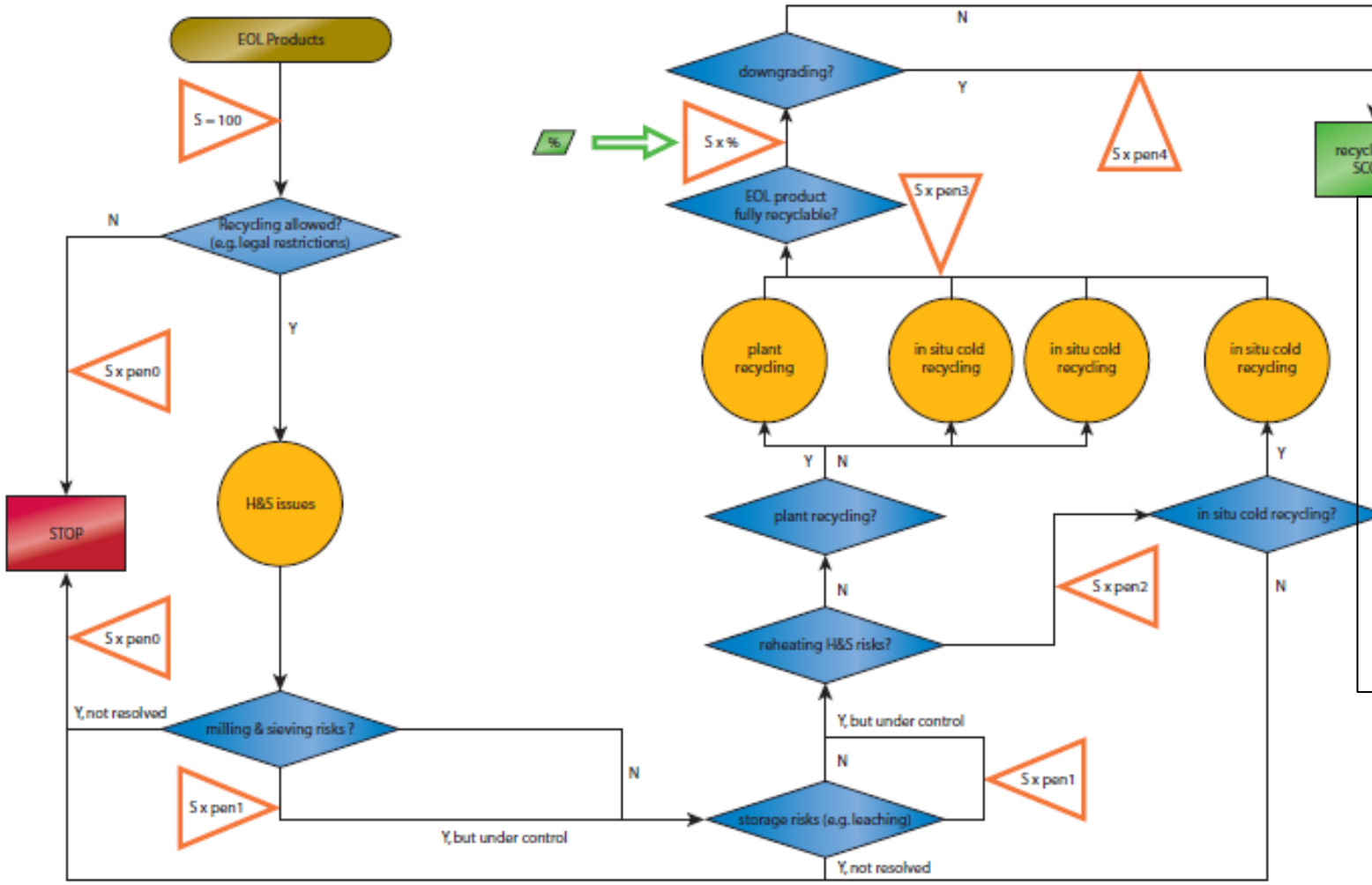
- "Matrix of concerns", showing which criteria might be a concern for each type of material/technology considered in D1.1

more details: EDGAR workshop session

Objectives (2)

1. Collect and summarize available information on sustainability aspects of new materials and technologies used in "green bituminous mixtures"
2. Propose a quick and qualitative system for the assessment of the recyclability of "green asphalt"

Outcome (2)



- 100 %: recyclable
- < 100%: recyclable, but additional measures will be required
- STOP: not recyclable (=NO GO!)

Objective (3)

1. Collect and summarize available information on sustainability aspects of new materials and technologies used in "green bituminous mixtures"
2. Propose a quick and qualitative system for the assessment of the recyclability of "green asphalt"
3. Select the relevant sustainability indicators for "green bituminous mixtures"

Outcome (3)

- Review of regulatory approach in Europe to standardise **environmental** information: Product Category Rules (PCRs) to produce Environmental Product Declarations (EPDs) of construction products (EN 15804)
- Wide review of **environmental and socio-economic** indicators with potential relevance to bituminous products

  ⇨ Deliverable D2.1 - Recommended product category rules for bituminous materials and technologies

  Main conclusions from D2.1

  ➢Assessment of indicators should be feasible (not too data nor time intensive)

  ➢Methodology should be based on manageable basket of indicators (±10)

  ➢Environmental indicator selection should be based on significance (done in next deliverable D2.2 by applying 'normalisation' to data retrieved from existing EPD's)

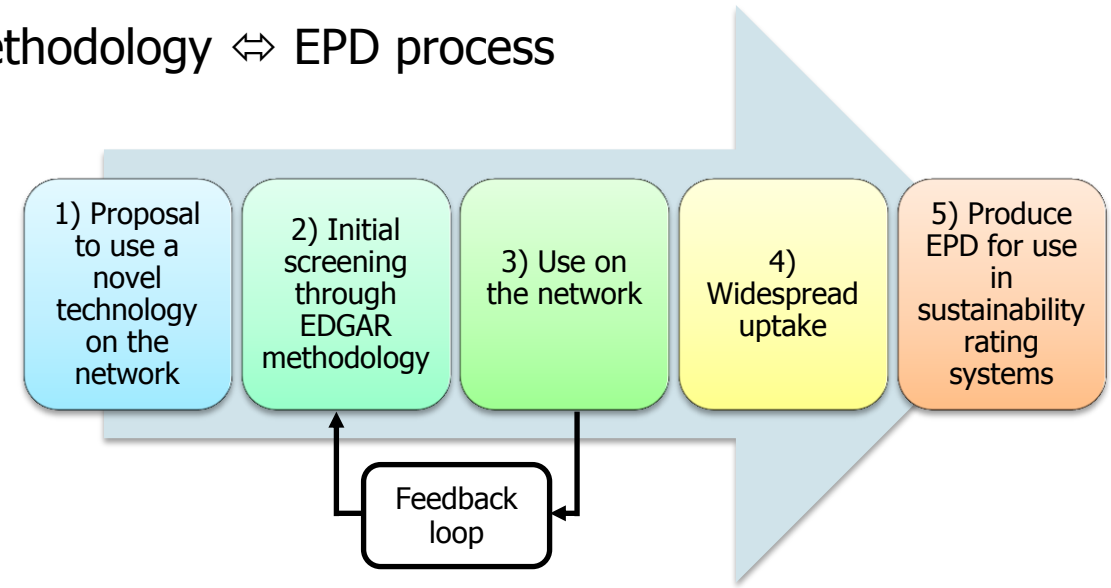
Outcome (3)

"Basket of indicators" : to choose from…

Indicator	Sub-indicators	Units
Global warming potential (GWP)		kg CO_{2e}/tonne asphalt
Depletion of resources (ADP)		kg Sb_e/tonne asphalt
Air pollution	Acidification potential (AP) "Smog" creation (POCP)	kg SO_{2e}/tonne asphalt kg $ethene_e$/tonne asphalt
Leaching potential		(tool dependent)
Noise reduction potential		dB
Recyclability		%
Skid resistance		(tool dependent)
Responsible sourcing		(tool dependent)
Life cycle cost		€
Traffic congestion cost		€
Performance	Rutting potential, Fatigue Water sensitivity, other, …	(property dependent)

Outcome (3)

EDGAR methodology ⇔ EPD process



⇨ Quicker and smoother adoption of novel technologies,
by gradually gaining evidence and increasing confidence

Note: EDGAR can facilitate any type of certification of sustainability
(e.g. LCE4 Roads)

Objective (4)

1. Collect and summarize available information on all sustainability aspects of new materials and technologies used in "green bituminous mixtures"
2. Propose a refined, quick and qualitative system for the assessment of the recyclability of "green asphalt"
3. Select the relevant sustainability indicators for "green bituminous mixtures"
4. Select the best tools for the evaluation of the sustainability indicators

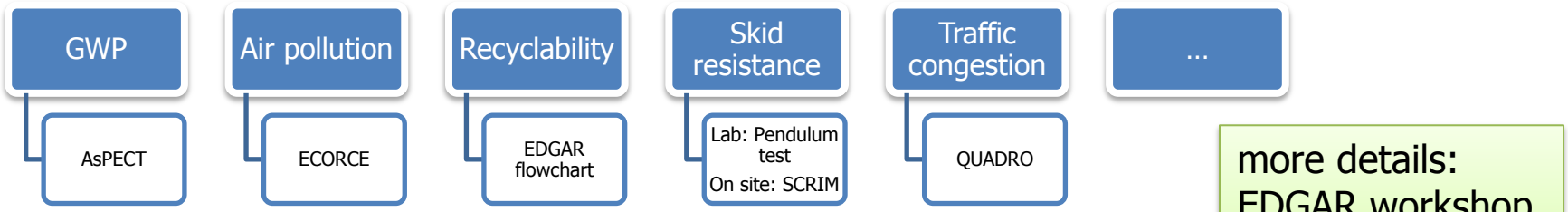
Outcome (4)

- Identification and evaluation of existing tools to assess each indicator

  Evaluation criteria: differentiation between types of asphalt, quantitative/qualitative, life cycle stages considered, transparency, cost effectiveness, …

  ⇨ Deliverable D2.2 – Guidance document on the sustainability assessment for bituminous materials and technologies

some “recommended” tools

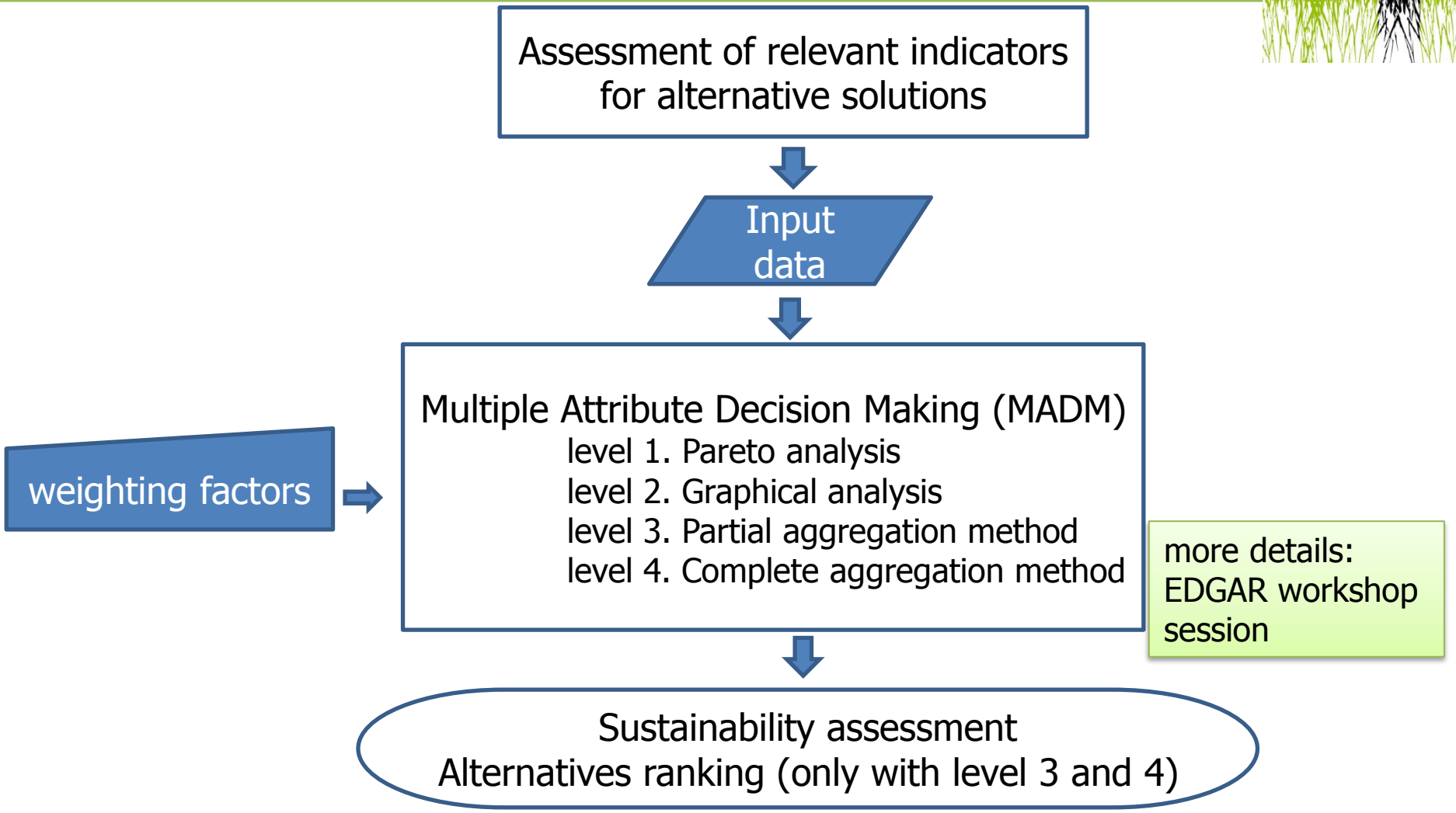


more details: EDGAR workshop session

Objective (5)

1. Collect and summarize available information on sustainability aspects of new materials and technologies used in "green bituminous mixtures"
2. Propose a refined, quick and qualitative system for the assessment of the recyclability of "green asphalt"
3. Select the relevant sustainability indicators for "green bituminous mixtures"
4. Select the best tools for the evaluation of the different sustainability indicators
5. Provide a methodology, built on the selected tools, for assessing any emerging material or technology and to evaluate its overall sustainability

Outcome (5)


Assessment of relevant indicators for alternative solutions
Input data
weighting factors
Multiple Attribute Decision Making (MADM)
level 1. Pareto analysis
level 2. Graphical analysis
level 3. Partial aggregation method
level 4. Complete aggregation method
more details: EDGAR workshop session
Sustainability assessment
Alternatives ranking (only with level 3 and 4)

Objective (6)

- Collect and summarize available information on all sustainability aspects of new materials and technologies used in "green bituminous mixtures"
- Propose a refined, quick and qualitative system for the assessment of the recyclability of "green asphalt"
- Select the relevant sustainability criteria for "green bituminous mixtures"
- Select the best tools for the evaluation of the different sustainability criteria
- Provide a methodology, built on the selected tools, for assessing any emerging material or technology and to evaluate its overall sustainability
- Demonstrate this methodology for a number of selected test cases

Outcome (6)

Selection made by project team, based on D1.1:

Case 1: HMA	Reference
Case 2: WMA	Case 1 + 3 m% wax on bitumen to reduce production temperature
Case 3: WMA with RA	Case 2 + 30% RA
Case 4: CIR	Cold in place recycling with bitumen emulsion + 1% cement
Case 5: HMA with steel slag	Case 1 + steel slag aggregate fraction 2/10 (instead of porphyry)

more details: EDGAR workshop session

Data based on a road section in Belgium, where both HMA (case 1) and WMA (case 2) have been applied

Outcome (6)

- Assessment of the basket of indicators for the 5 alternatives
- Application of the MADM methods

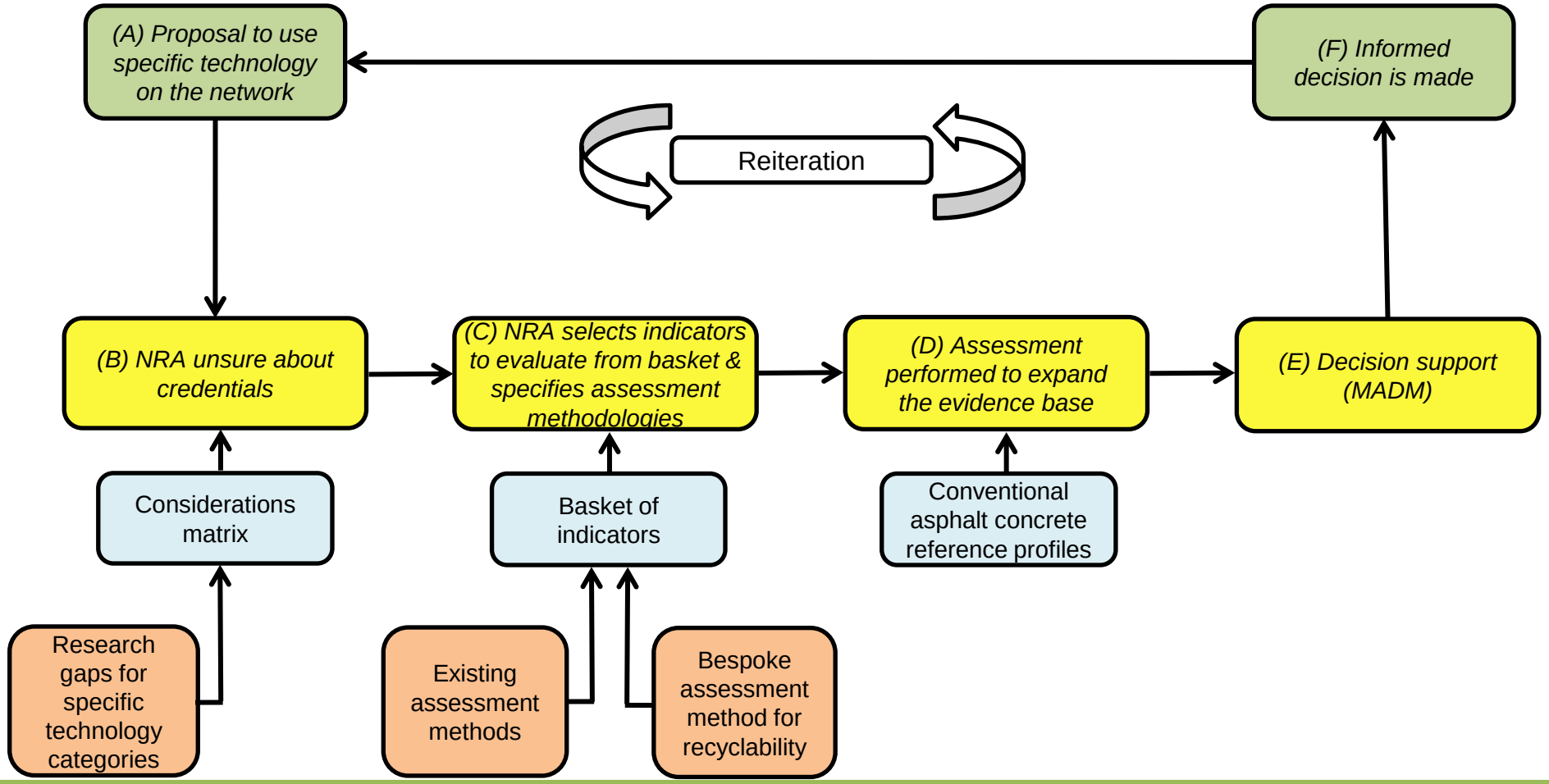
  ⇨ Deliverable D3.1 – Demonstration of the methodology to assess sustainability

  Main conclusions from D3.1

  - Difficult to find accurate data (especially for CIR)
  - Performance is a crucial indicator ⇨ need to cover all essential characteristics (resistance to rutting, ravelling, cracking, stripping, …)
  - Use stage is dominant for GWP and air pollution ⇨ importance of rolling resistance!
  - Sensitivity analysis allows to assess the impact of weighting coefficients and other parameters

General conclusions

- The EDGAR project set up a general methodology for NRAs



General conclusions

- The use of a such a methodology will:

  - ✓ raise awareness of the essential indicators to be assessed for asphalt roads
  - ✓ urge suppliers/contractors to provide reliable data and evidence
  - ✓ increase confidence in novel 'green' techniques
  - ✓ enhance quicker adoption of the most sustainable solutions
  - ✓ facilitate communication between NRA and suppliers/contractors

- The methodology was applied in a case study, showing:

  strong points : feasability, transparency and flexibility, ability to deal with data uncertainties, …

  weak points : lack of accurate input data, user friendliness and foolproofness of the MADM tool

  ⇨ perspectives to improve the methodology!

The way forward…

- Try out the methodology in pilot projects

- Improve MADM tool:
  - more user friendly
  - more foolproof (prevent input of unsensical data, weighting factors, threshold values, …)
  - provide guidelines for choosing weighting factors, evaluating robustness of solutions, deal with uncertain data, …

Feedback by potential users: see this afternoon workshop sessions!

Thank you for your attention

All deliverables available at

https://www.ntnu.edu/edgar

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