37TH INTERNATIONAL NO-DIG FLORENCE 2019

Fortezza da Basso • FLORENCE (Italy)

30th September • 2nd October 2019

SELECTION OF CRITERIA AND METHODS FOR A COMPARATIVE EVALUATION OF ENVIRONMENTAL SUSTAINABILITY OF OPEN-CUT AND NO-DIG TECHNOLOGIES FOR NEW INSTALLATIONS AND IN SITU REHABILITATION OF SEWER PIPES

Martina Ferrini[1], Valentina Castellani[2], Nadia Mirabella[3], Serenella Sala[4], Stefano Tani[5] and Valeria Mezzanotte[1]

[1] DISAT, Università degli Studi di Milano Bicocca, Piazza della Scienza, 1, 20126 Milano, Italy
[2] Sustainability Consultant
[3] KU Leuven, Department of Architecture, Kasteelpark Arenberg 1, 3001, Leuven, Belgium
[4] JRC Ispra (VA), Italy
[5] MM SpA

Sustainable development of new technologies

Technological assessment is necessary when the development of new technologies can potentially cause a series of undesirable effects from a social, occupational, environmental, cultural, technical and economic standpoint

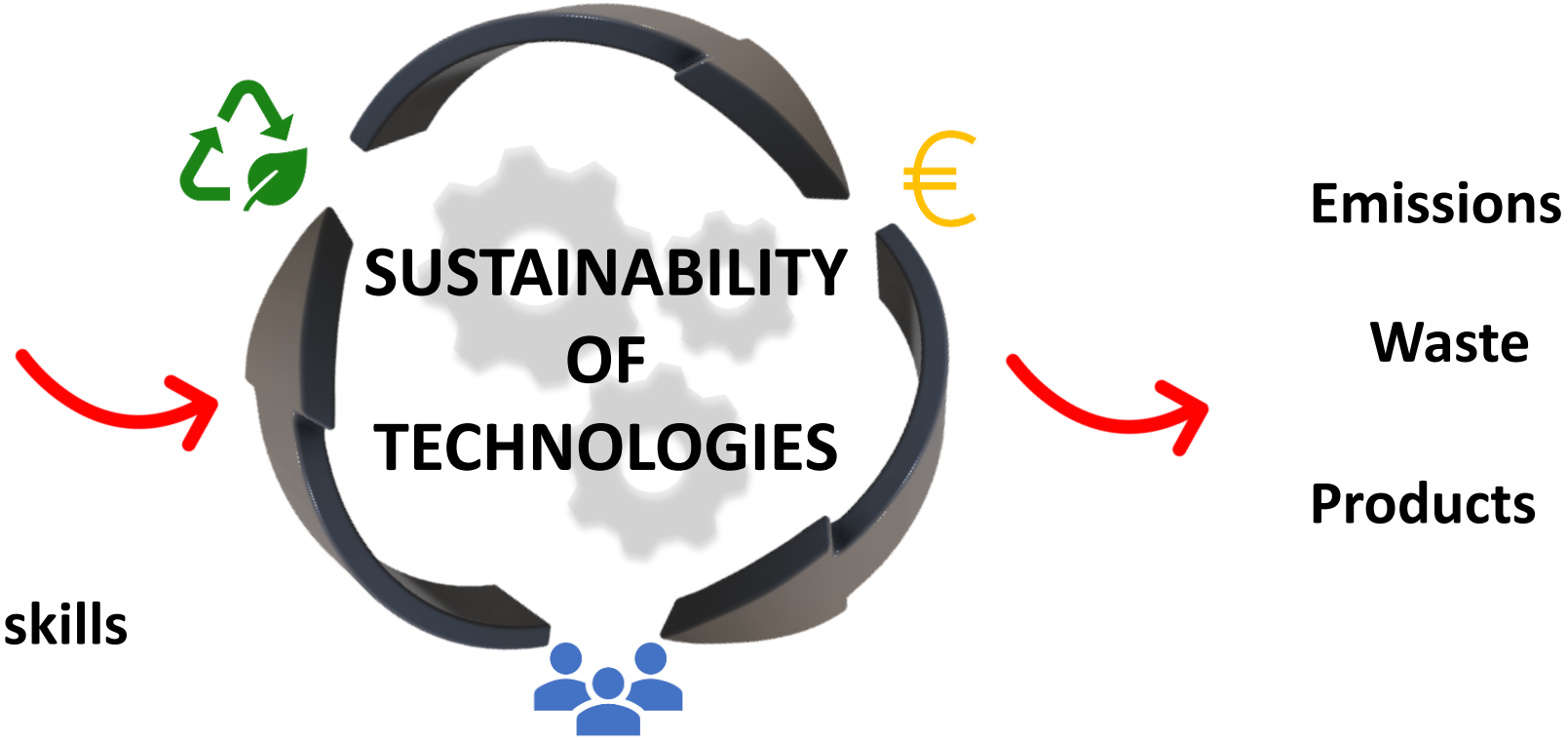
Energy

Materials

Transports

Infrastructures

Labour and skills

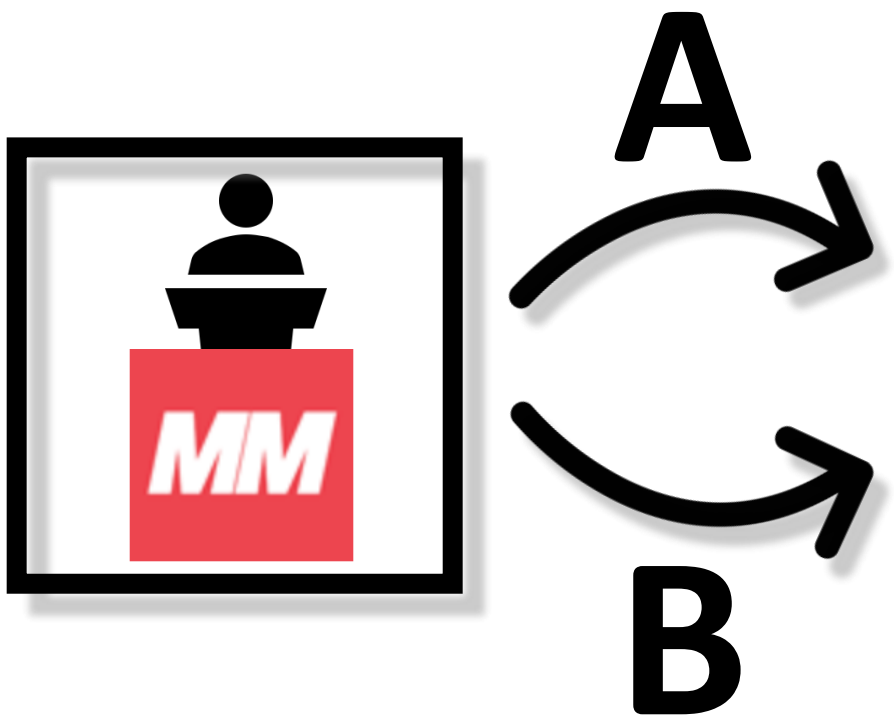


Emissions

Waste

Products

MM S.p.a. case studies

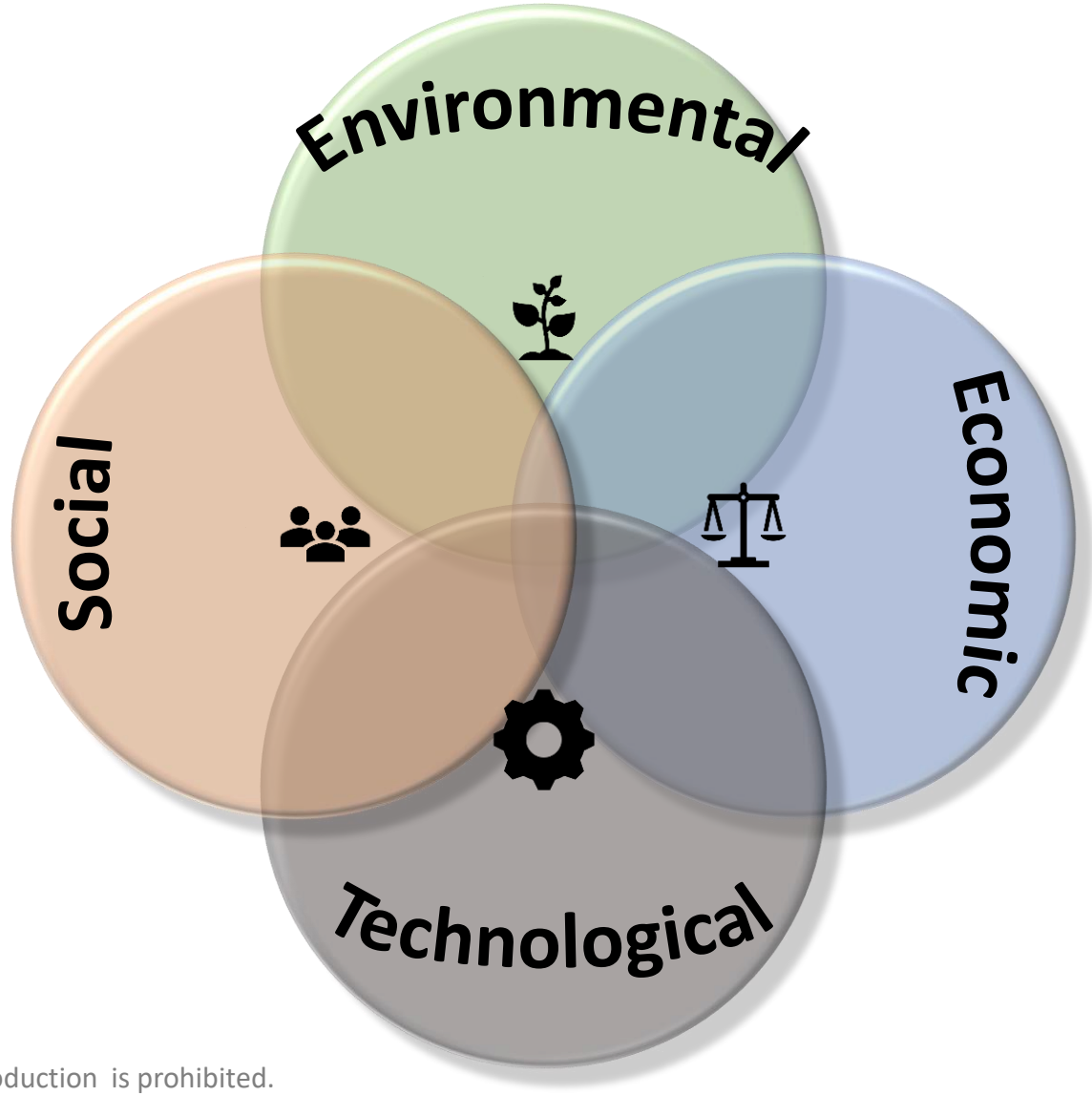


NO-DIG TECHNOLOGY → Rehabilitation of existing sewers by CIPP technologies

TRADITIONAL OPEN-CUT → Construction of a new sewerage system

Sustainability Assessment of Technologies (SAT)

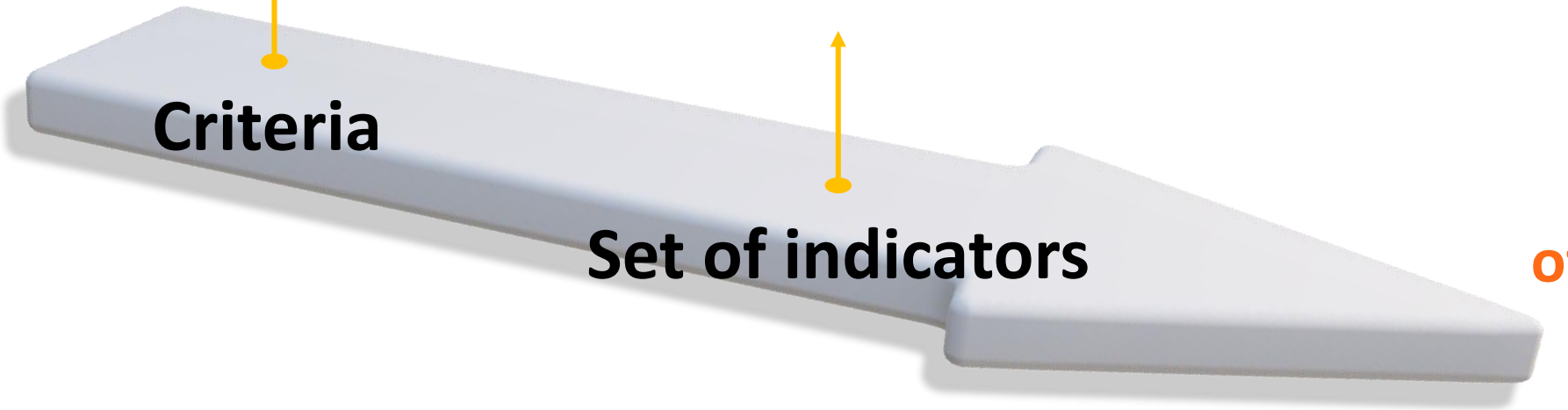
Term used to describe
a complex approach
to appraise the sustainability
of different technologies



Approach adopted for sustainability assessment

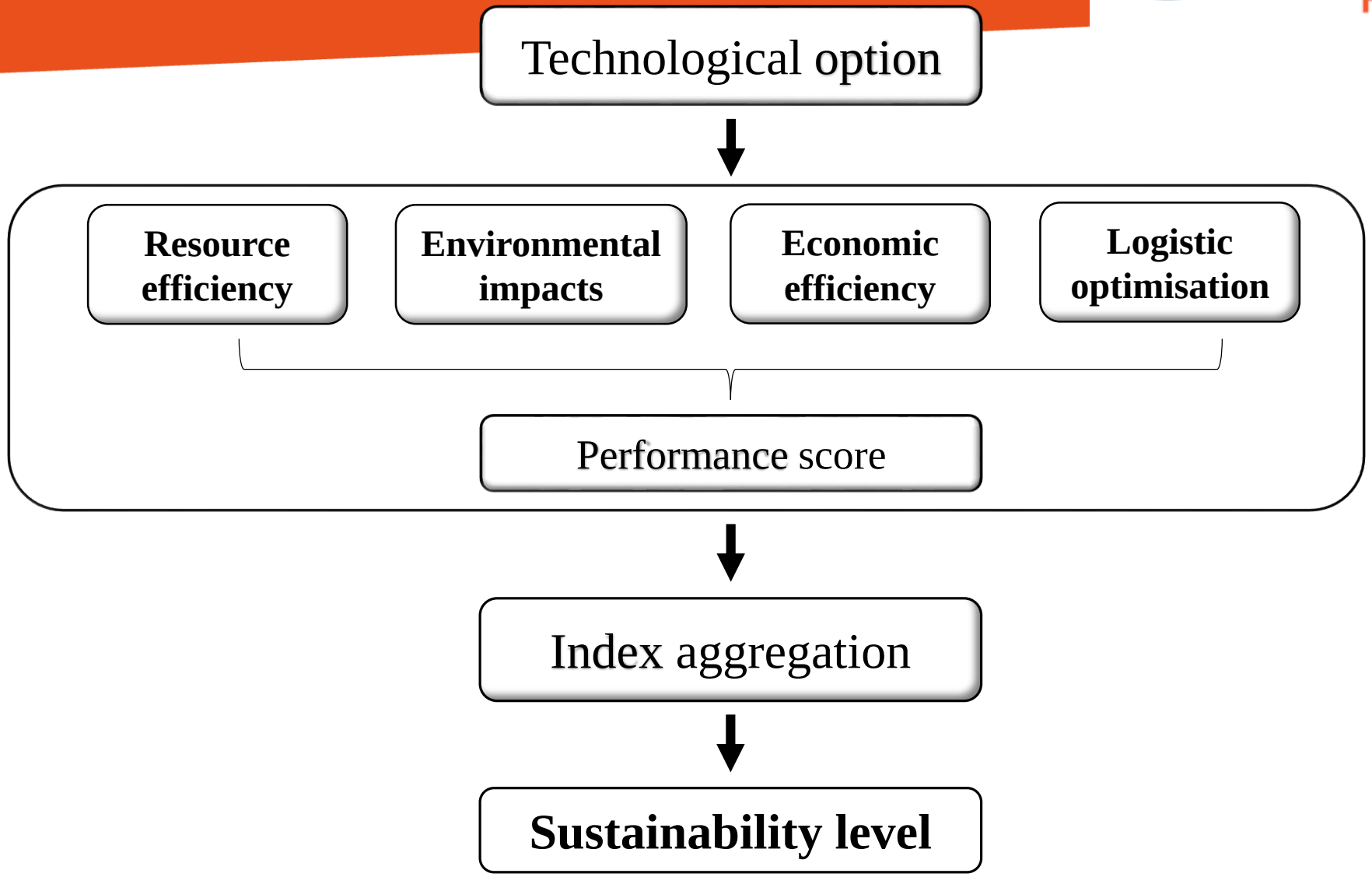
- ❑ Efficiency of both material and energy resources
- ❑ Process and logistics optimization
- ❑ Reduction of overall environmental impact
- ❑ Financial profitability
- ❑ Ability to generate positive economic and social effects in the local context

- ❑ Environmental, economic and social sustainability

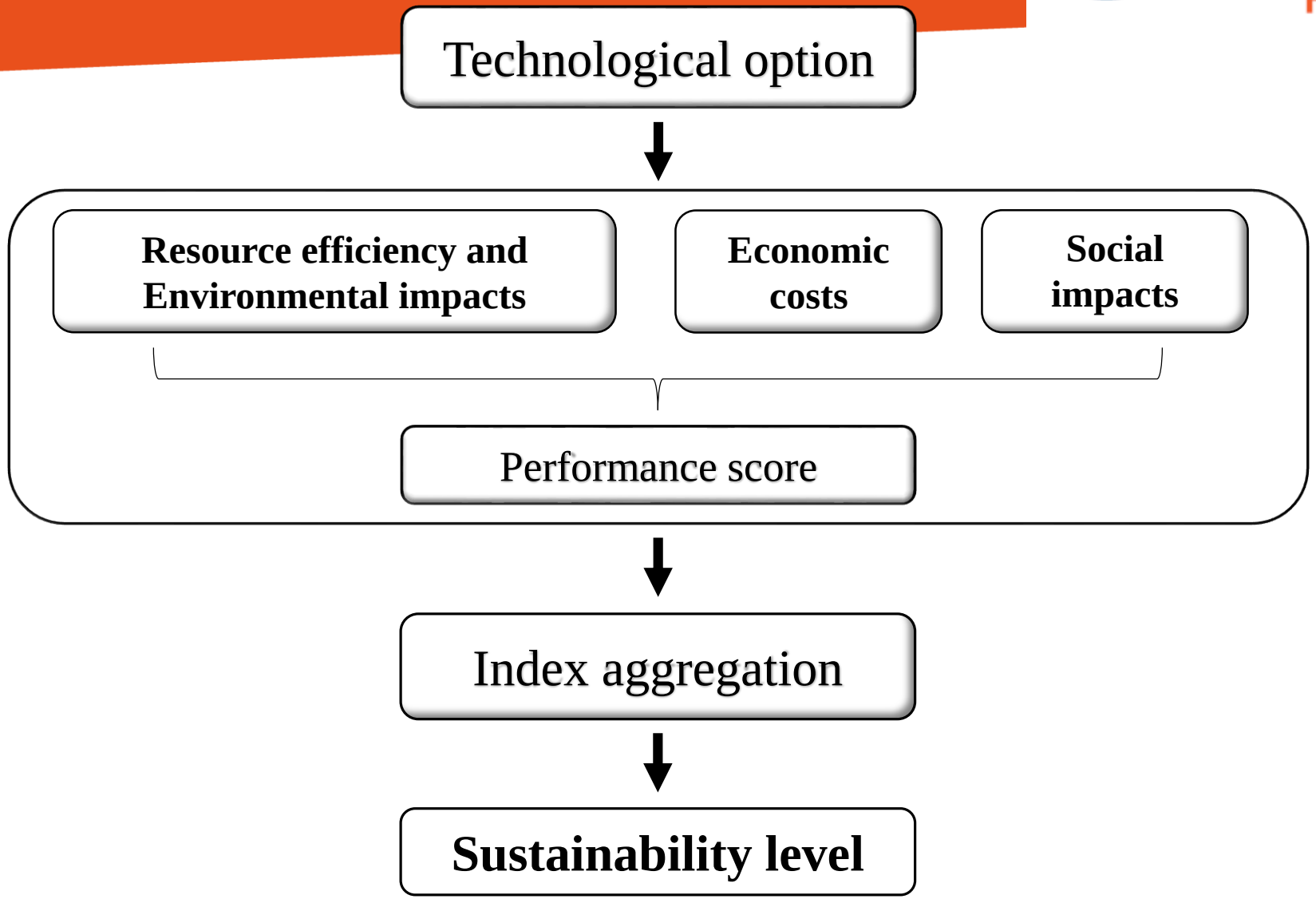


Sustainability assessment of the considered system

SAT methodology



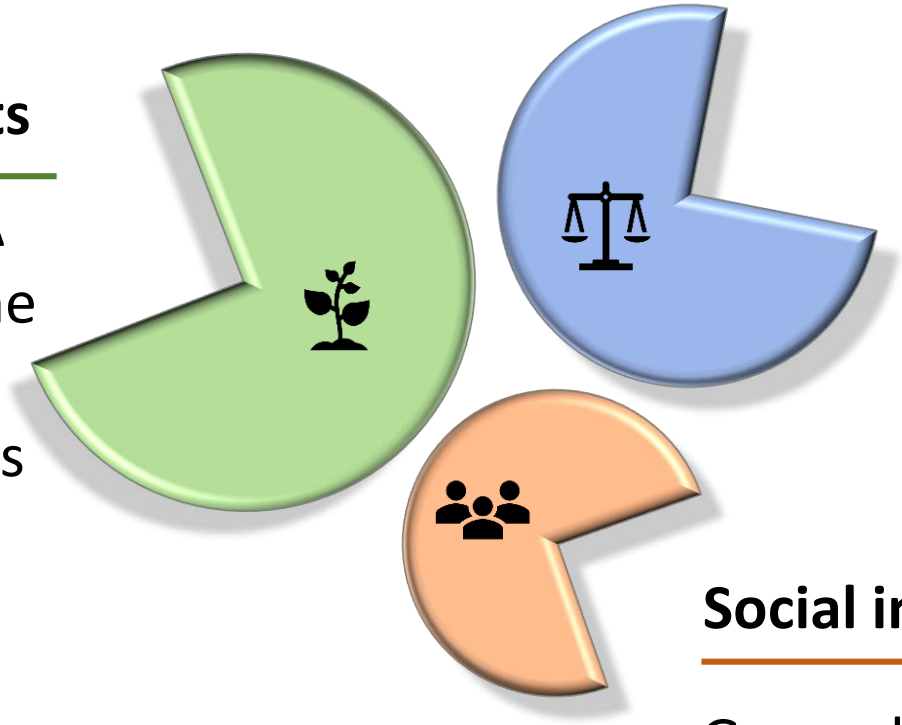
Comparative Sustainability Assessment of Technology CSAT



Assessment of environmental impacts by LCA

Environmental impacts

Development of a **LCA** analysis to quantify the potential environmental impacts



Economic costs

Direct costs directly linked to the construction of the project; they refer to the costs of conception, development and implementation

Social impacts and costs

Generalised indirect costs (**IGC**) and costs related to potential community risks

Assessment of environmental impacts

Definition of the local context

- Case A: no-dig
- Case B: open-cut

Choice of the functional unit

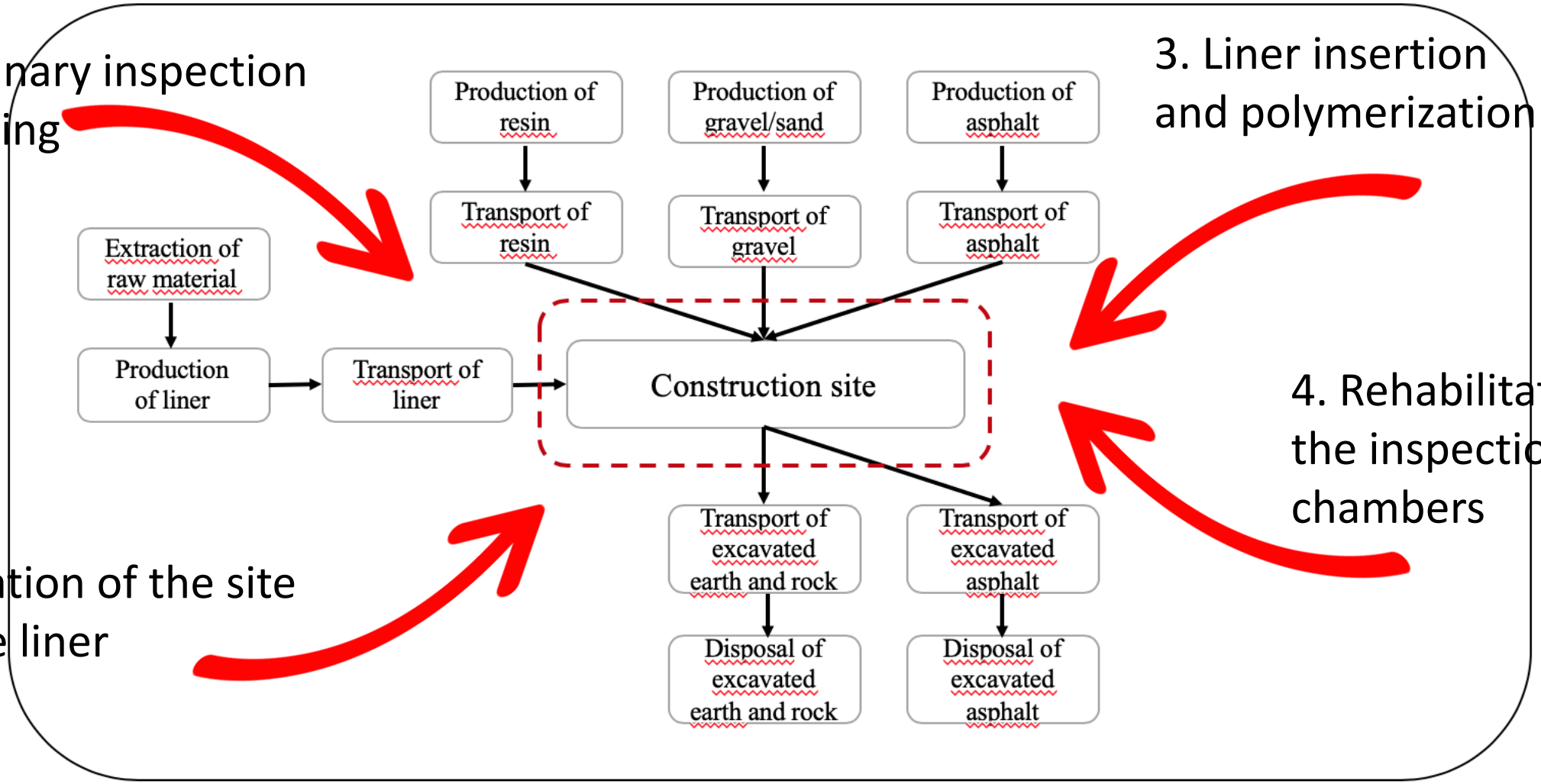
- 100 m of sewer

Definition of the system boundaries

- Extraction and production of raw materials;
- Transport and distribution;
- Installation, use and maintenance;
- Final disposal

System boundaries No-dig construction site

1. Preliminary inspection and cleaning



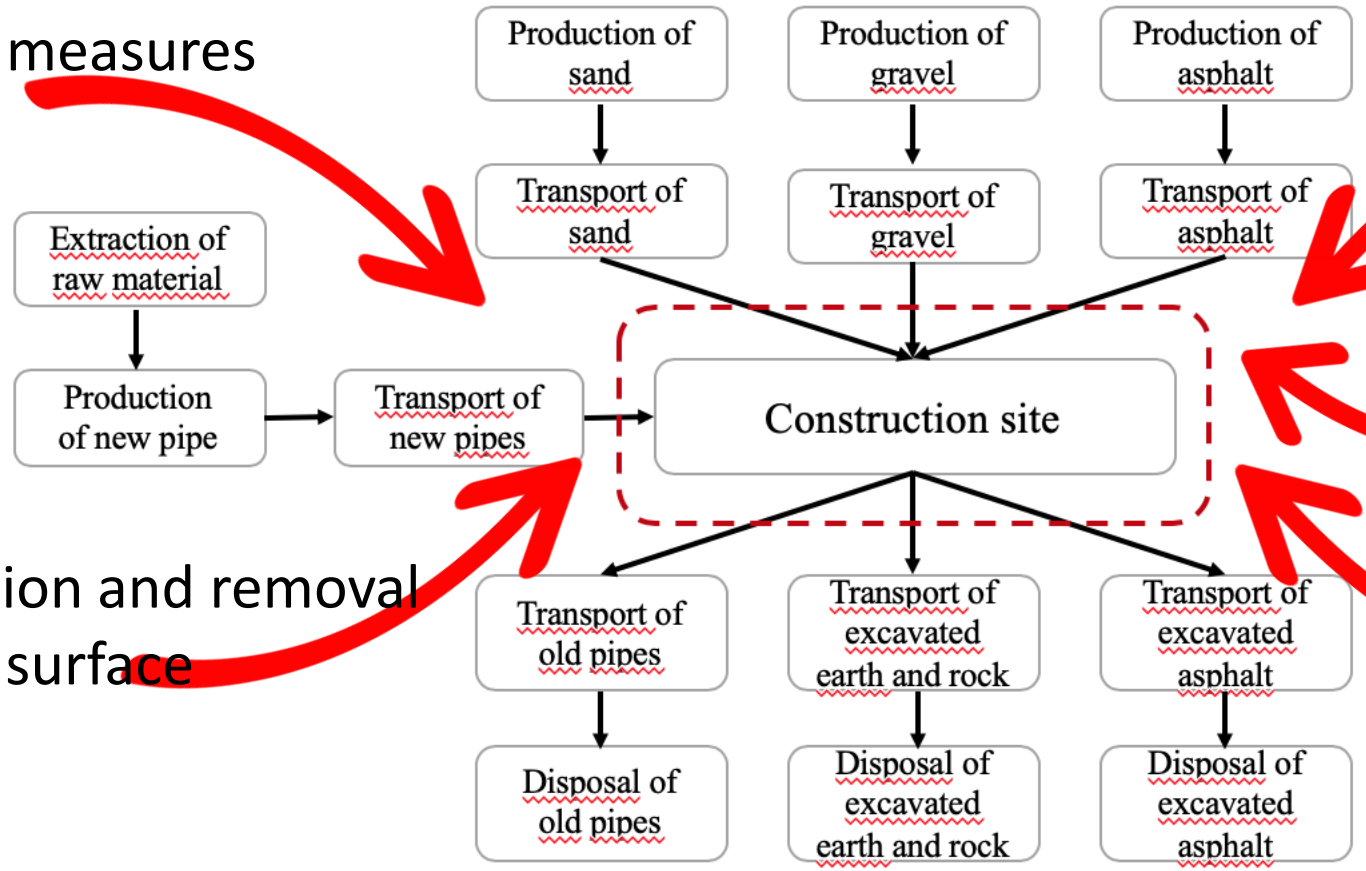
2. Preparation of the site and of the liner

3. Liner insertion and polymerization

4. Rehabilitation of the inspection chambers

System boundaries Open-cut construction site

1. Traffic diversion and road safety measures



2. Scarification and removal of the road surface

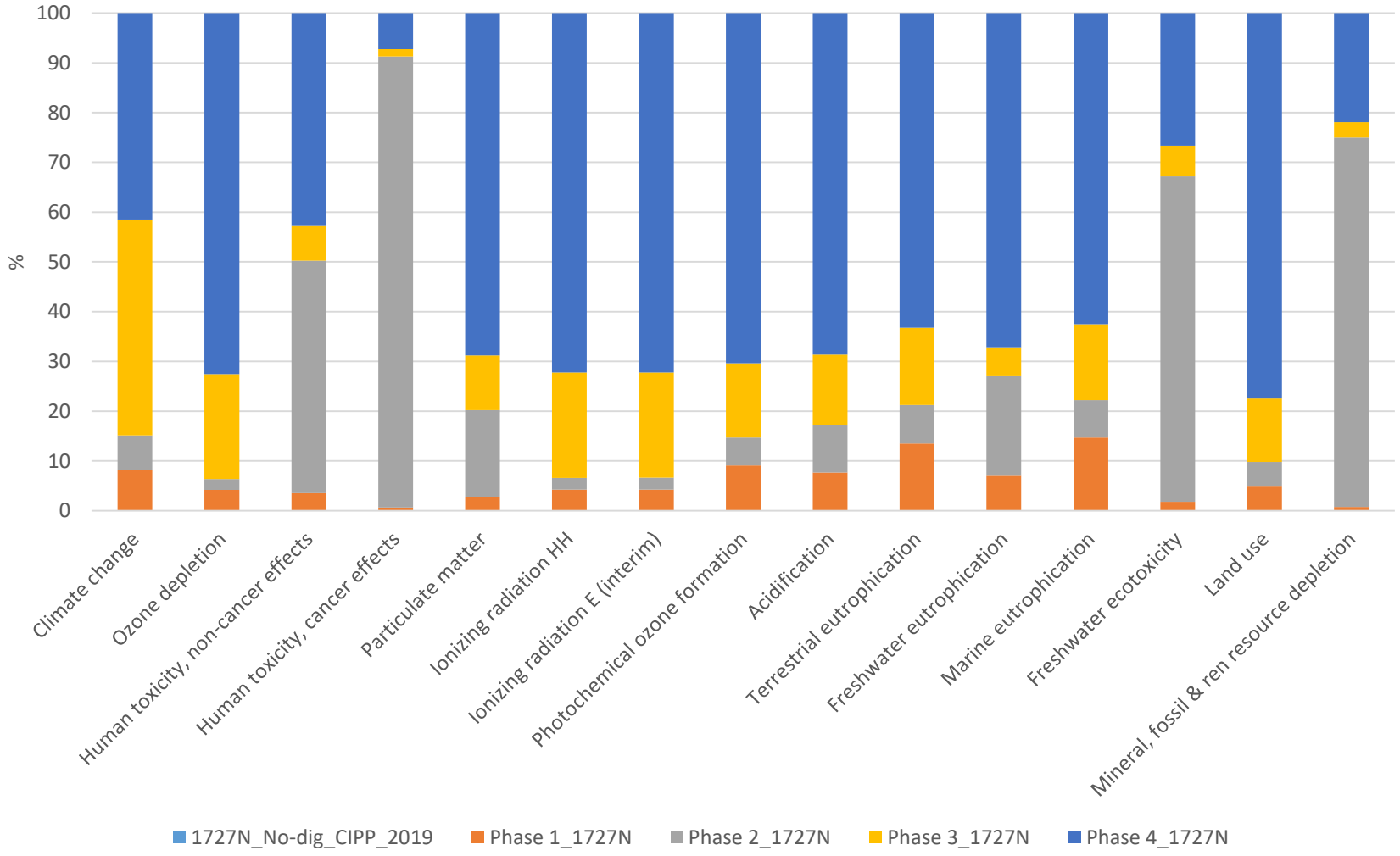
3. Excavation and new pipe laying

4. Filling the trench with sand, excavated earth and temporary asphalt

5. Final phase of asphalt optimization

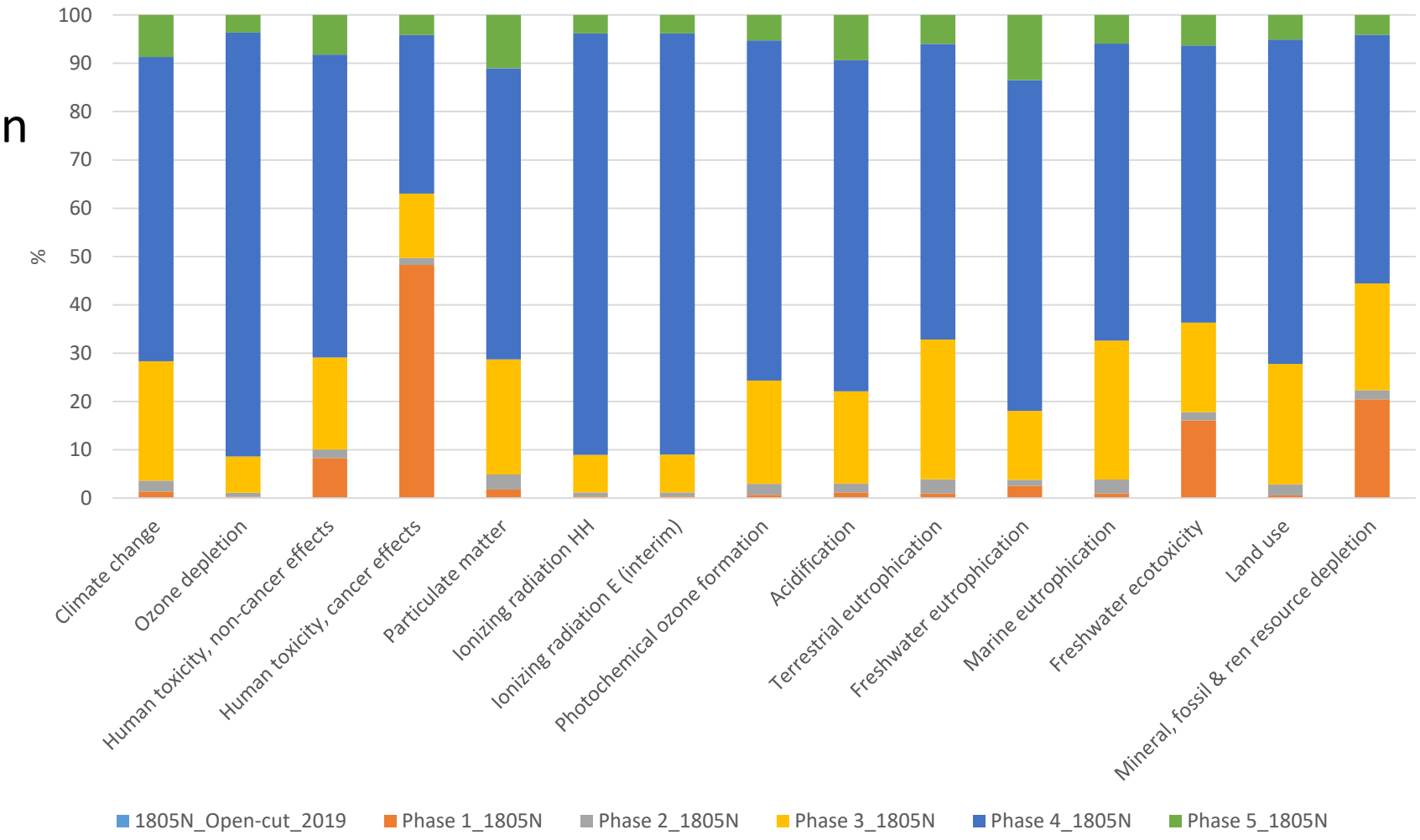
Case A: no-dig

Relative percent contribution of the main construction phases to overall environmental impact for each impact category



Case B: open-cut

Relative percent contribution of the main construction phases to overall environmental impact for each impact category



Economic costs

Direct costs

Case A: no-dig

Length of the rehabilitation section 465.23 meters
Total amount estimated by CME: € 393,894
Estimated amount on 100 linear meters: € 84.708,41

Case B: open-cut

Length of the section about 820 meters
Total amount estimated by CME: € 932,087
Estimated amount on 100 linear meters: €113.669,25

Social impacts and costs

Social costs

Indirect Generalized Cost (IGC)

- Vehicle operating costs
- Traffic delay
- Loss of parking areas
- Air, water, acoustic pollution

Social costs related to the risk

- Accidents to workers, or users
- Damage to infrastructures, or properties

Example: Calculation of Traffic Delay Cost (TDC)

$$DT = Lw/Sw - Ln/Sn$$

$$CD = DT \times VOT \times ANP$$

$$TDC = CD \times NVD \times D$$

Lw: Length of the work area including deviations (km)
Sw: speed through the work area (km / h)
Ln: Length of the work area in normal conditions (km)
Sn: normal speed (km / h)
DT = Delay Time (h)
VOT = value of time (euro / person * hour)
ANP = average number of people per vehicle.
NVD = n. of vehicles per day
D = duration of the construction works

For the no-dig construction site, the traffic delay is less than the traffic delay in the case of an open-cut construction site.

Conclusions

Criteria for assessing the sustainability of technological solutions

Set of indicators of sustainability assessment

Thanks for your attention!