

Workshop on project preparation process
with reference to EU and WBIF requirements

Options Analysis

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Options Analysis



Purpose

Choice of an alternative, which satisfies the criteria to a maximum degree



Conditions

Clear strategic context and objectives



Results

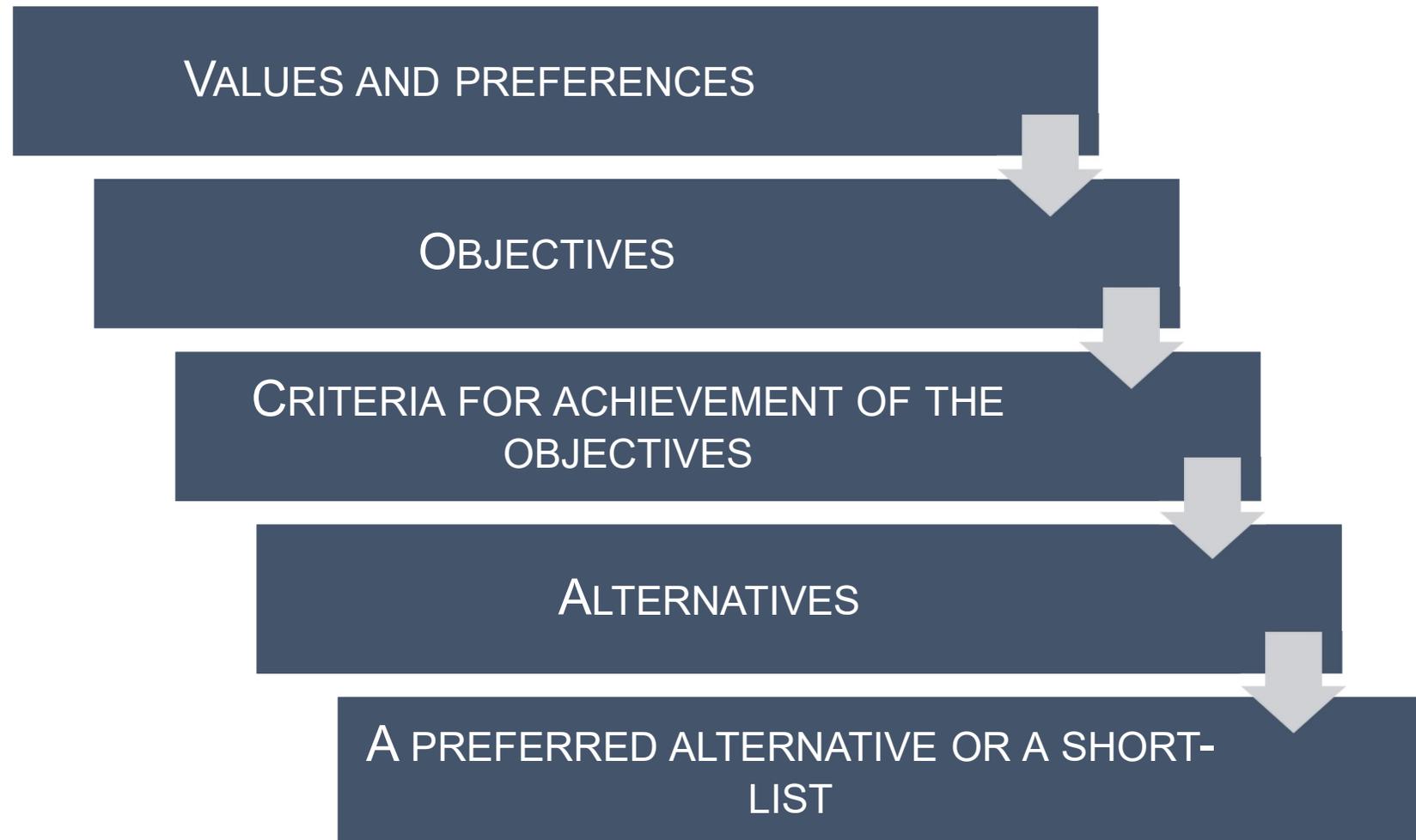
A preferred alternative (corridor), to be studied in detail



Timing

As part of the feasibility study

! Definitions and concepts (1)



! Definitions and concepts (2)

- It is feasible to differentiate between an alternative and an option:
 - *Alternative* – an idea for achieving the objectives, which is not necessarily very specific or defined in much detail; alternatives are expected to have *qualitative differences*
 - *Option* – a specific and well defined solution to achieve the objectives; options are expected to have *quantitative differences*
- *Multi-criteria analysis* – a comparison of the performance of alternatives/options against the set objectives

① 1.1 Is the option analysis done during the feasibility stage, is it an update, or is it an ex-post analysis to support a preferred option?

- It is critical that the analysis is done at *feasibility stage*, and not to simply justify a decision already taken
- Best for achieving an optimal solution is to make comparisons *incrementally* at each project development stage:
 - comparison of fundamentally different *alternatives* to maximize the performance under different objectives
 - comparison of *options*, developed in detail within the corridor of the preferred alternative
 - comparison of *technological solutions* for the most important components of the preferred option (i.e. tunnels, long bridges/viaducts, etc.)

② 1.2 Is the *strategic context* of the project defined?

- The project implementation framework needs to be considered, e.g. the hierarchy of objectives at
TEN-T level ⇒ transport corridor ⇒ investment programme or national strategic documents

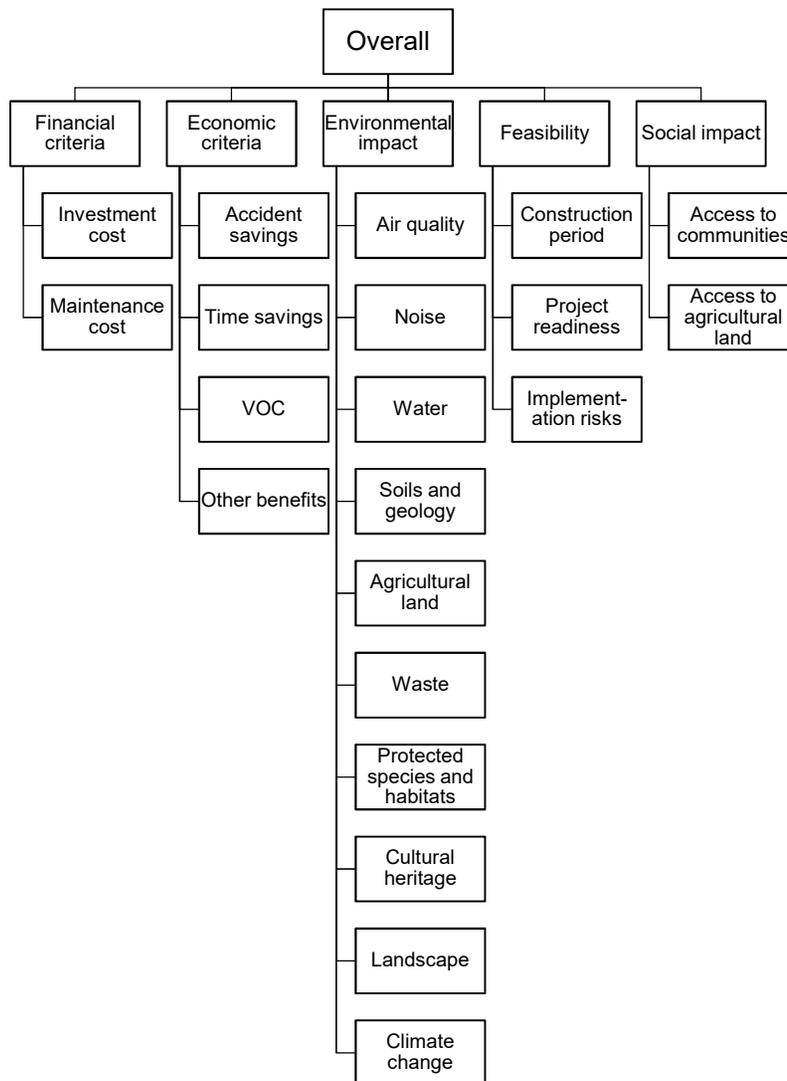
② 1.3 Are the objectives of the project defined?

- Most often the objectives of transport projects are related to:
 - contribution to welfare – decreased traveltime, operating costs, accident rates, etc.
 - limiting (or even reducing) of negative impacts to environment – e.g. noise, air pollution, etc.
 - other objectives – e.g. improved access to social services, to agricultural land, etc.



Examples

A typical hierarchy of objectives



- ② 2.1 Does the analysis have two stages – one for comparing alternatives at the *strategic level* and one to compare short listed project options?
- As pointed out in 1.1, it is most useful to perform the analysis in stages
- ② 2.2 How is the second stage of the analysis performed?
- One option is to use simplified economic analysis for the comparison
 - A *better way* is to use MCA with the following groups of criteria:
 - economic performance (ENPV)
 - environmental impacts

② 2.3 Has *climate change* been considered in the process of developing and comparing the alternatives/alignment options?

- Ideally, at least a preliminary CC VRA must be prepared before the comparison of options

② 2.4 Is there sufficient evidence provided to demonstrate that the preferred option is the optimal of the ones considered?

- The analysis must demonstrate that the preferred option is the best
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② 3.1 *Are the strategic alternatives properly defined?*

- Mostly in terms of location and dimensions

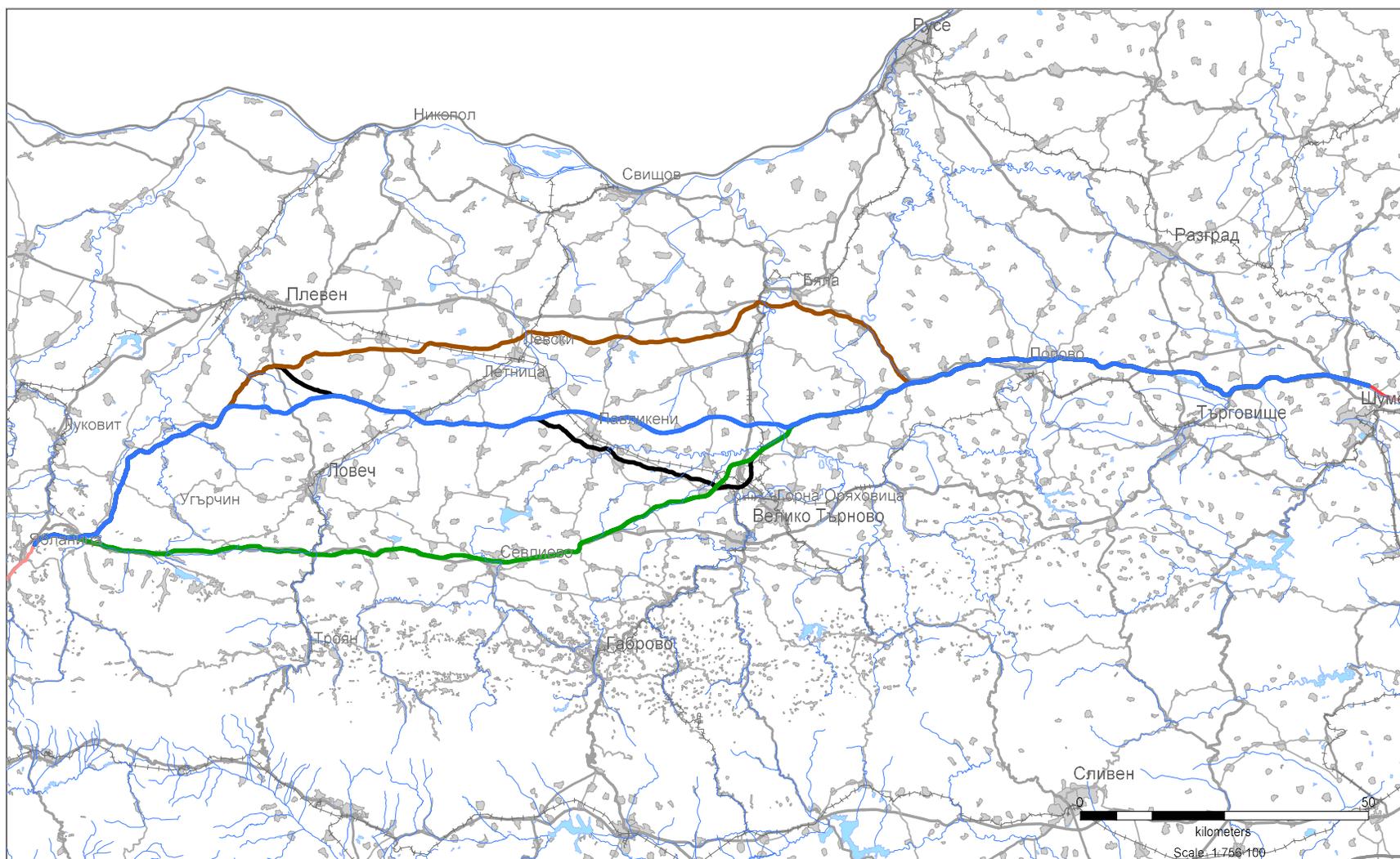
② 3.2 *Do all alternatives have the same / similar / compatible objectives?*

- If alternatives from old studies are being examined, it is possible that they have different objectives
 - It needs to be confirmed that the objectives are acceptable from the present perspective
 - Certainly different alternatives will satisfy the objectives to different degrees
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Examples

Strategic alternatives with different objectives



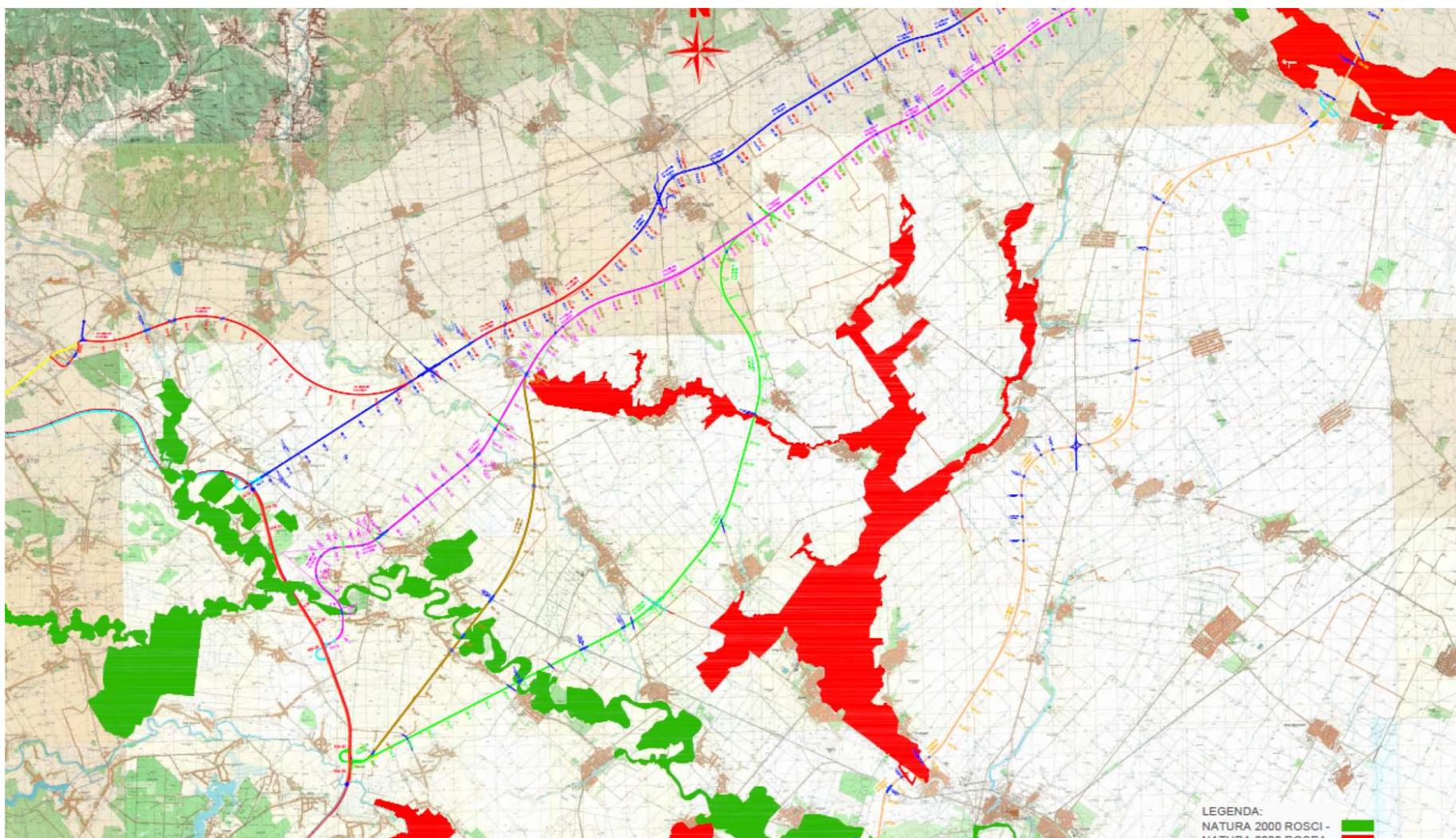
② 3.3 Are the alternatives too similar?

- They should not be!
 - The purpose of the comparison is to review a *wide range* of potential approaches to satisfying the objectives
-



Examples

Too similar alternatives



② 3.4 Is the set of criteria *complete*?

- Does it allow evaluation of the *most important* attributes of the alternatives?
- Can it properly *differentiate* between the alternatives?
- Does it include reasonable technical, economic, environmental, climate change, and institutional criteria?

② 3.5 Are there *redundant* criteria?

- ... i.e. criteria, which compare unimportant / irrelevant attributes of the alternatives

② 3.6 Are the criteria *mutually independent*?

- ... i.e. can each of them be evaluated without knowing how other criteria have been evaluated

② 3.7 Is there *double counting* (i.e. evaluating one effect, or parts thereof, under more than one criterion)?

- It is *recommended* to avoid double counting
- However, it is not a major issue, provided it is specified what aspects the criteria evaluate and they are different
- Often double counting can be avoided by joining criteria

Examples

Dependent criteria (double counting)

Example 1:

- ENPV
- Investment costs



Investment costs are a major component of ENPV, i.e. it is being considered twice. Furthermore, it is unclear what negative effects it is supposed to represent. In general, it is not specified to which objectives the criteria contribute to

Examples

Dependent criteria (double counting)

Example 2:

- Economic performance (evaluated using ENPV)
- Difficulties in securing financing (evaluated using investment costs)



The meaning behind the investment costs criterion is clarified, and it does not overlap the other criterion

② 3.8 Are the criteria *weights* defined and how were they determined?

- If no weights are selected, then the criteria will in effect have equal weights
- (And if a group has more criteria, it will have a higher weight.)
- Methods for selecting weights:
 - *Direct rating* – the criteria are awarded scores according to their perceived importance; the ratings are averaged and normalised to come up with the criteria weights
 - *Fixed-point scoring* – a fixed amount of points is distributed among the criteria
 - *Swing weighting* – the criteria are ranked by importance, considering the best and worst performance for each of them

② 3.9 Are the criteria score scales defined?

- ... i.e. is it clear what parameter level/value results in what score?
- The scaling function may be increasing, decreasing, as well as linear or non-linear
- The following scoring methods are possible:
 - *Global scaling* – 0 for worst **acceptable** performance level and maximum score for the **best possible**
 - *Local scaling* – 0 for worst **actually incurred acceptable** performance level and maximum score for **best**
 - *Hybrid scaling* – 0 for worst **acceptable** performance level and maximum score for the **best actually incurred**

Examples

Local scaling

Performance of the alternatives	Alternative 1	Alternative 2
Timesavings (MEUR)	51	50
Investment costs (MEUR)	90	60

Scores	Alternative 1	Alternative 2
Timesavings (weight 55%)	55.0	0.0
Investment costs (weight 45%)	0.0	45.0
	55.0	45.0



Because of the scoring method, alternative 1 is awarded higher total score, although it is only marginally better in terms of timesavings and much worse in terms of investment cost

Examples

Hybrid scaling

Performance of the alternatives	Alternative 1	Alternative 2
Timesavings (MEUR)	51	50
Investment costs (MEUR)	90	60

Scores	Alternative 1	Alternative 2
Timesavings (weight 55%)	55.0	53.9
Investment costs (weight 45%)	30.0	45.0
	85.0	98.9



In this case, small differences in the performance under the criteria lead to small differences of the scores.
(Although if both timesavings and costs are in monetary values, they must have the same weight.)

Criteria

- ③ 3.10 Common sense check – are there any criteria which weights or ranges appear unreasonable (both compared against all other criteria and relative to the rest of the criteria individually)?
- An attempt to identify serious errors and omissions
- ③ 3.11 Common sense check – do the criteria cover both the benefits and costs of the alternatives?
- If mostly benefits are evaluated, the analysis may be optimistic



Examples

Evaluation criteria

No.	Criteria	Weight
1	Contribution to the improvement of the traffic conditions	60%
1.1	▪ Separation of transit and internal traffic flows	5%
1.2	▪ Connectivity between planned options and the existing network	5%
1.3	▪ Decrease of the saturation rate of the ring-road	40%
1.4	▪ Improvement of the Service Level on the ring-road	10%
2	Environmental Impact	15%
2.1	▪ Impact on Natura 2000 areas	10%
2.2	▪ Surface of new constructed road infrastructure	5%
3	Social Impact	15%
3.1	▪ Surface of land to be expropriated in build-up area (estimated)	10%
3.2	▪ Number of households/ families to be affected	5%
4	Risks (to be synthetize in a risk matrix)	10%
4.1	▪ Risks related to climate change impacts and weather extremes	4%
4.2	▪ Interference of the project with build-up area and related	3%
4.3	▪ Interference with other major infrastructure	3%
	TOTAL	100%



Scores and ranking

- ③ 3.12 Is the data available sufficiently precise to allow scoring ?
- Most importantly, are *investment costs* and *demand* determined well enough for all of the alternatives
- ③ 3.13 Are the criteria correctly scored in accordance with their pre-defined ranges?
- ③ 3.14 Are the total scores and ranking correctly calculated?
- Technical checks

② 3.15 Is there a *sensitivity analysis* included? What is the approach and is the analysis stable?

- The results of the analysis depend *equally* on the precision of the performance levels and the weights
- Sensitivity analysis can be performed *both* on the weights, as well as on the performance levels
- The following methods can be used:
 - Weight scenarios
 - Changing the weight of different criteria (or criteria groups) from 0 to 100%
 - Varying the performance levels for an alternative under a particular criterion from best to worst value
 - Monte Carlo simulation



Examples

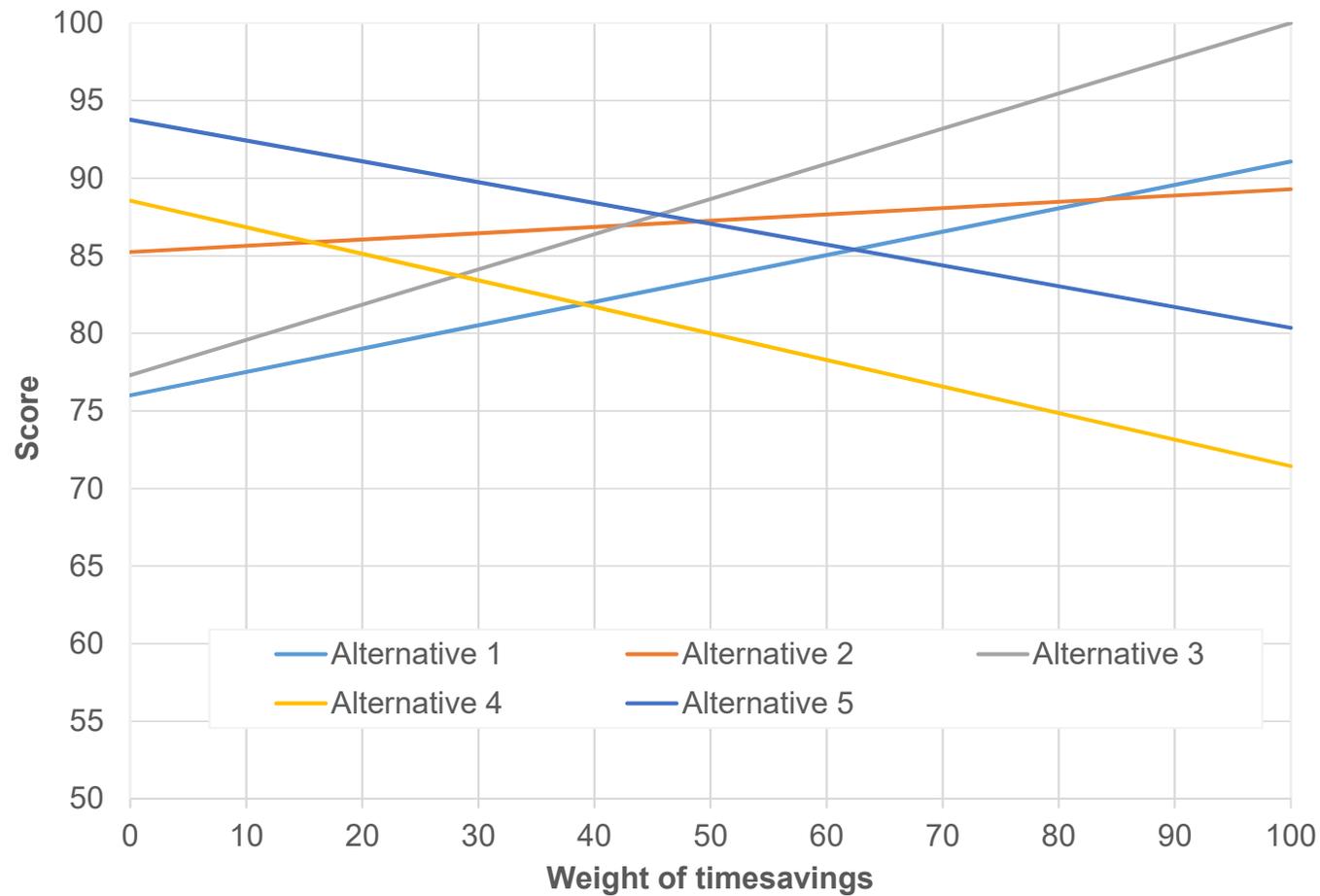
Weight scenarios

	Indicator	Long Dual Tunnel	Long Single Tunnel (uni)	Long Single Tunnel (bid)	Dual Carriageway	Staged Dual Carriageway	Western
Standard Assessment	Financial Criteria	7.5	8.9	9.4	23.7	23.5	9.9
	Economic Criteria	25.0	25.0	25.0	24.7	24.6	23.8
	Environmental Impact – Construction	19.9	20.6	20.6	14.3	13.8	17.1
	Environmental Impact – Operation	16.2	15.2	15.3	11.1	10.6	13.2
	Feasibility Criteria	5.3	4.3	4.3	7.0	6.0	2.7
	Level of Service Criteria	2.3	2.7	0.7	3.0	3.0	2.3
	Total	76.2	76.7	75.3	83.8	81.5	69.0
	Ranking	4	3	5	1	2	6
Assessment A Environmentally Weighted	Financial Criteria	5.9	7.1	7.5	19.0	18.5	7.8
	Economic Criteria	25.0	23.9	25.0	24.6	23.1	23.4
	Environmental Impact – Construction	9.4	9.6	9.6	7.7	7.5	8.7
	Environmental Impact – Operation	36.1	36.2	35.5	26.0	25.2	28.2
	Feasibility Criteria	3.3	3.4	3.4	4.7	4.7	2.7
	Level of Service Criteria	0.8	0.9	0.2	1.0	1.0	0.8
	Total	80.5	81.1	81.2	83.0	80.0	71.6
	Ranking	4	3	2	1	5	6
Assessment B Economically Weighted	Financial Criteria	9.1	10.6	11.3	28.3	28.5	12.1
	Economic Criteria	30.0	28.7	30.0	29.5	27.8	28.1
	Environmental Impact – Construction	12.2	12.6	12.6	9.2	8.9	11.1
	Environmental Impact – Operation	18.0	17.8	17.6	12.5	12.0	14.2
	Feasibility Criteria	3.7	3.3	3.3	4.3	4.3	2.0
	Level of Service Criteria	1.6	1.8	0.4	2.0	2.0	1.6
	Total	74.6	74.8	75.2	85.8	83.5	69.1
	Ranking	5	4	3	1	2	6



Examples

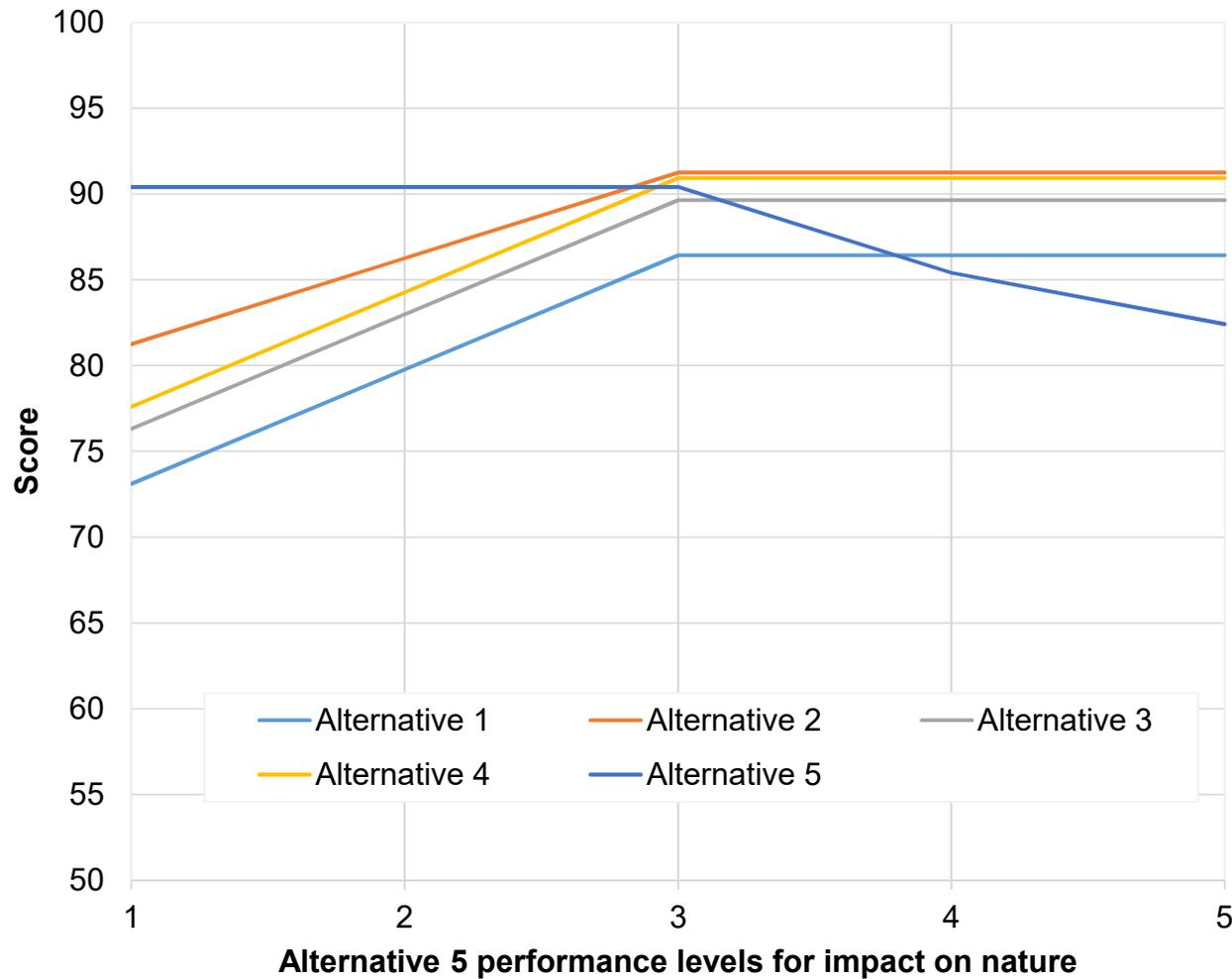
Changing the weight of a criterion from 0 to 100%





Examples

Varying the performance levels under a criterion





Examples

Summary of a Monte Carlo simulation

	Minimum	Maximum
Timesavings	-5	+2
Investment costs	-5	+15
Exposure to noise and pollution	-10	+20
Impact on nature	-1	+1

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Times ranked first	156	708	614	749	2 774
Probability for first	3.1%	14.2%	12.3%	15.0%	55.5%

Comparison of options

② 4.1 Do all options have the same *objectives*?

- The objectives of the options need to be specified in detail and to be the same (or very similar) for all options

② 4.2 Are the options *similar* enough?

- The options must be sufficiently similar, to allow comparison with simplified economic analysis or with predominantly quantitative criteria

② 4.3 Is the comparison of “*technological options*” of the important components of the project presented in the MCA?

- It is highly recommended to include a description of the technologies compared for execution of the major project components – e.g. pavement, tunnels, bridges/viaducts, etc.

Simplified economic analysis

- ④ 4.4 Is the set of effects being evaluated under the simplified economic analysis complete?
 - ④ 4.5 Is the data available sufficiently precise to allow preparation of the simplified economic analysis (e.g. demand, cost and other data)?
 - ④ 4.6 Is the simplified economic analysis based on realistic assumptions (e.g. for economic parameters, infrastructure development scenarios, etc.)?
- Questions to ensure the quality of the simplified economic analysis