



FAST DANUBE

***Technical Assistance for Revising and Complementing the Feasibility Study
Regarding the Improvement of Navigation Conditions on the Romanian-Bulgarian Common Sector of the Danube and
Complementary Studies***



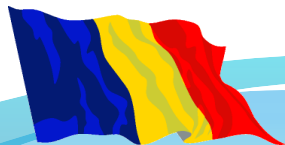
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<i>Time</i>	<i>Topic</i>	<i>Responsible</i>
09:00 – 09:30	<i>Registration / Coffee</i>	<i>All</i>
WORKSHOP ON «Options Appraisal / Selection for FAST DANUBE project»		
09.30 – 9:45	Introduction: <ul style="list-style-type: none"> – Welcome – H&S moment – Project status 	Mr. Dan TARARA Mr. Romeo SOARE
09.45 – 11.00	Session 1: <ul style="list-style-type: none"> – Initial option preferences, morphological (Prof Colin Thorne via skype) – Revised options, modelling / engineering / CBA – Environmental studies – Q&A 	Mr. Paul RAYNER Mr. Damian DEBSKI Ms. Roxana DORNEANU Ms. Charlotte HANDY
11.00 – 11.30	<i>Coffee break</i>	
11.30 – 13.00	Session 2: <ul style="list-style-type: none"> – Multi-criteria analysis: introductory session 	Mr. Dan TARARA Mr. Paul RAYNER Ms. Roxana DORNEANU Ms. Charlotte HANDY
13.00 – 13.45	<i>Lunch</i>	
13.45 – 15.30	Session 3: <ul style="list-style-type: none"> – Multi-criteria analysis: interactive session 	Mr. Dan TARARA Mr. Paul RAYNER
15.30 – 16.00	Session 4: <ul style="list-style-type: none"> – Consensus view on long term sustainable options 	Ms. Roxana DORNEANU Ms. Charlotte HANDY
16.00	Closing statement	Mr. Romeo SOARE



Multi Criteria Analysis

- MCA is a tool to help us reach a preferred option
- MCA undertaken for all options presented at the previous workshop
- Will now explain the MCA methodology. . .



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MCA Purpose

Introduction

Multi Criteria Analysis (MCA) is a technique used to help the appraisal of alternative options to select which option best achieves an agreed objective. It provides us with a framework within which we can assess and compare up the relative strengths and weaknesses of each option and select a preferred option. The technique can be applied across a broad range of decision making situations – for example see http://forlearn.jrc.ec.europa.eu/guide/4_methodology/meth_multi-criteria-analysis.htm#Outputs

MCA works by evaluating, in a systematic way, each alternative option against a set of agreed decision criteria. These criteria reflect sub-objectives, requirements and constraints that are relevant to choosing a preferred option. MCA supports evidence-based decision-making; it does not automatically tell us what the best option is.

MCA is often used to supplement an economic appraisal, such as Benefit-Cost Analysis (BCA). In carrying out a full BCA we have to quantify in monetary terms all the costs and all the benefits of each alternative option. This may not be possible, and in these circumstances, MCA helps compare options in a semi-quantitative way.

We can, if appropriate, refine the way in which we select a preferred option by applying weights to each of decision criterion to indicate their relative importance in relation to one another. For example, do we consider that the technical aspects of an option are more or less important to us than its environmental, economic or social aspects. Or, are all aspects equally important?



MCA Application to FAST Danube

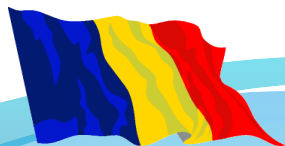
The application of MCA to FAST Danube

The overall purpose using MCA on the FAST Danube project is to help us, iteratively, to choose a preferred option from the options proposed at each site.

The MCA framework we have developed for Fast Danube uses the evidence we have collected and obtained from analyses carried out during the course of our project activities. It allows us to carry out a relative comparison of options, from the most preferred to the least preferred option at each of the critical areas. This comparison is based upon the ability each option to satisfy the overall project objective as well as its ability to meet secondary objectives relating to technical, economic, environmental and social issues, requirements and constraints relevant to the project.

At the outset of applying the MCA, we recognise that options may differ in the extent to which they achieve the sub-objectives, requirements and constraints associated with the project and no one option is likely to be best in achieving all objectives.

In developing the MCA framework for FAST Danube, we have:



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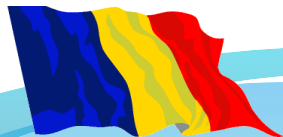


Application to FAST Danube

- 1) **Established an overall objective for the project** - The primary (overall) objective of FAST Danube project is *to ensure unimpeded navigation for at least 340 days/year including for flows < 3000 m³/sec by maintaining a fairway of adequate width and depth with an appropriate alignment*
- 2) **Agreed a number of secondary project objectives** covering the four key areas of: technical/geomorphological aspects; financial aspects; social aspects and environmental – these secondary objectives have been developed over the course of project to date
- 3) **Developing alternative interventions at each critical site** on the lower Danube – these options, developed by integrating principles of river engineering with our understanding of river geomorphology have then been tested using the hydrodynamic and sediment transport modelling.

In the preliminary versions of the MCA, presented at the project workshop on 17th May 2018, we provided a preliminary assessment of different generic types of intervention ranging from dredging alone to combinations of dredging and river engineering interventions. This early application of MCA enabled us to identify that the implementation of bottom sills would be unacceptable from an environmental perspective.

The MCA framework in its present form is being used to help us to compare the extent to which each alternative option (for meeting the overall project objective at each critical site) could satisfy the requirements and constraints within each decision criterion.



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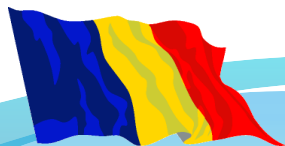
MCA Scoring

Decision criteria have been agreed and are listed, under each of the project objectives, in the *Scoring Matrix* worksheet. The *Scoring Matrix* summarises the rules and tests by which each option has been scored against each decision criterion. By applying these rules and tests systematically, across all options, we ensure that each option is evaluated in a consistent manner across each project objective and each critical site.

An option can score between +3 and -3 against each criterion, to reflect where the extent to which it meets or satisfies each criterion:

- +3 score signifies that it makes a **strong positive** contribution to meeting the criterion
- +2 score signifies that it makes a **positive** contribution to meeting the criterion
- +1 score signifies that it makes a **weak positive** contribution to meeting the criterion
- 0 score signifies that it makes a **neutral** contribution to meeting the criterion
- -1 score signifies that it makes a **weak negative** contribution to meeting the criterion
- -2 score signifies that it makes a **negative** contribution to meeting the criterion
- -3 score signifies that it makes a **strong negative** contribution to meeting the criterion

We have applied the MCA framework to assessing the current options proposed at each critical site and identifying a preferred option. The degree of detail used in the assessment reflects the evidence and information that we have collected and developed during the project to date. The degree of detail of information used in the MCA is broadly proportionate to the potential significance of the decision criterion.



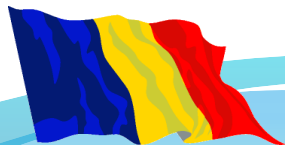
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MCA Scoring matrix

Objective	Technical / Morphology	Financial	Social
Score	Treats root cause of navigation impediments by working with natural hydro-morphological and sediment transport processes in order to stabilise desirable fairway conditions	Economically attractive and financially affordable	Avoid adverse impacts upon people, services and livelihoods, taking into account relevant climate change aspects
3	a. Treats root cause of impediments to navigation.	a. Net Present Cost < €10million	a. Reduced flood risk, predicted to decrease water levels by >0.5m - we need to revise these thresholds and tie them into a specific discharge (e.g. bankfull discharge)
	b. Works well with other types of intervention (does not restrict the selection of subsequent interventions).	b. Construction costs < €10million	b. Permanent improvements to ports and or other facilities.
	c. Maintains full hydraulic connectivity between river channels, river banks and flood plains.	c. Maintenance costs < €250,000 per annum.	c. No river bank erosion (i.e. loss of productive land / assets).
	d. Avoids high flow velocities, turbulence and scour and undesirable sediment transport.		
	Overall, the option is likely to stabilise desirable fairway conditions		



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MCA Weighting (1 of 3)

The process of scoring and weighting has been applied in the following way to help us select a preferred option:

- 1) For each option at each site we have carried out an MCA; on the basis of this assessment we have summarized the total scores against each secondary objective (or decision-criterion) for each of the time periods considered – see worksheet *MCA-Score*.
- 2) An example of such a summary is shown below. The purpose of the following tables is to show the average scores for two alternative options 1 implemented at location XXX. Note that the Average score across the time periods considered for each decision-criterion could lie within the range +3 and -3.

Location: XXX	Option 1	Sum of scores for each decision-criterion (taken from the MCA worksheet) / number of sub-criteria			
Decision-Criteria	Number of sub-criteria ¹	Implementation	Medium term	Long term	Average
Technical/morphological	4	$8/4 = 2$	$12/4 = 3$	$12/4 = 3$	2.7
Financial	3 (2)	$6/3 = 2$	$1/3 = 0.3$	$2/3 = 0.7$	1
Environmental	9	$-18/9 = -2$	$-9/9 = -1$	$-9/9 = -1$	-1.3
Social	3	$-1/3 = -0.3$	$1/3 = +0.3$	$1/3 = +0.3$	0.3
Total average					$2.7/4 = 0.68$

Notes: (1) Each sub-criterion can have a score between a maximum of +3 and a minimum of -3

Location: XXX	Option 2	Sum of scores for each decision-criterion (taken from the MCA worksheet) / number of sub-criteria			
Decision-Criteria	Number of sub-criteria ¹	Implementation	Medium term	Long term	Average
Technical/morphological	4	$8/4 = 2$	$4/4 = 1$	$4/4 = 1$	1.3
Financial	3 (2)	$9/3 = 3$	$3/3 = 1$	$3/3 = 1$	1.3
Environmental	9	$-9/9 = -1$	$-9/9 = -1$	$-9/9 = -1$	-1
Social	3	$-1/3 = -0.3$	$1/3 = +0.3$	$1/3 = +0.3$	0.3
Total average					$1.9/4 = 0.48$

Notes: (1) Each sub-criterion can have a score between a maximum of +3 and a minimum of -3



MCA Weighting (2 of 3)

Assuming all the decision-criteria are of equal importance, we can add the average scores across the decision-criteria in which case Option 1 would score a total average score of 0.68 and Option 2 would score a total average score of 0.48, indicating that Option 1 is

In the case that the decision-criteria are not of equal importance we need to derive and apply relative weights to each criterion. This process is illustrated in the following tables.

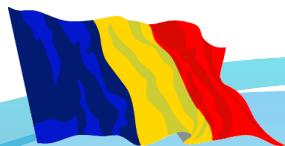
In order to derive weights, we first need to determine the relative values placed against each decision criterion by applying the

- If criterion A is valued more than criterion B then A scores 2 against B and B scores 0 against A
- If criterion A is of equal value to criterion B then A scores 1 against B and B scores 1 against A

We then carry repeat this assessment by evaluating each of the decision criteria, in turn, against all the other decision-criteria. Applying the above rules we then fill in a matrix from which we can derive relative weights.

This process is illustrated below where we have, for example, elicited from decision-makers and/or stakeholders that:

- The **Technical/morphological** criterion is considered to be **more** important than the **Economic** criterion
- The **Technical/morphological** criterion is considered to be **less** important than the **Environmental** criterion
- The **Technical/morphological** criterion is considered to be **equally** important to the **Social** criterion
- The **Financial** criterion is considered to be **equally** important to the **Environmental** criterion
- The **Financial** criterion is considered to be **more** important than the **Social** criterion
- The **Environmental** criterion is considered to be **equally** important to the **Social** criterion.



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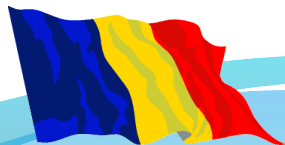
MCA Weighting (3 of 3)

	Technical/ morphological	Financial	Environmental	Social
Technical/morphological		0	2	1
Financial	2		1	0
Environmental	0	1		1
Social	1	2	1	
Total	3	3	4	2
Relative weight ¹	0.25	0.25	0.33	0.17

Note: (1) The relative weight derived for each criterion is the (total column score)/12, where 12 is the total number of cells that can be filled in.

Location XXX	Equal weights	Option 1	Option 2	Relative weights	Option 1	Option 2
Technical/morphological	0.25	2.7	1.3	0.25	2.7	1.3
Financial	0.25	1	1.3	0.25	1	1.3
Environmental	0.25	-1.3	-1	0.33	-1.3	-1
Social	0.25	0.3	0.3	0.17	0.3	0.3
Total weighted average score		0.68	0.48		0.55	0.37

The above table confirms that even with a stronger weight applied to **environment**, Option 1 is still preferable to Option 2.



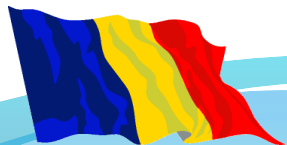
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MCA – Your thoughts

- Scoring . . .
- Weighting . . .



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