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

Qualitative Risk Analysis

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12 October 2022, Belgrade

European Investment Bank The EU bank

Jaspers Joint Assistance to Support Projects in European Regions

European Commission

Qualitative Risk Analysis

Purpose	To identify the main risks for the project and formulate measures for avoiding them or mitigating the negative impacts from them
Conditions	Some clarity regarding project's parameters
Results	Action plan for avoiding the risks or mitigating their impacts
Timing	As part of the feasibility study. Execution of the action plan during project's lifecycle

Definitions and concepts (1)

- *Risk* is an *event*, occurring with some *probability* within a *period of time*, and negatively affecting the adopted *objectives*

- *Quantitative risk analysis* – when for the purpose of defining risks the probabilities are determined using measured *frequencies* of the events, and the negative effects are quantified (e.g. in monetary terms)

- *Qualitative risk analysis* – when subjective levels of risk expectance are used (i.e. *likelihood* levels), and the negative effects are evaluated qualitatively

Definitions and concepts (2)

- Risks can be compared by determining their *level* (i.e. *dis*-utility) – by multiplying the likelihood and impact levels:

Risk level = Likelihood level x *Impact level*

(i.e. similar to von Neumann-Morgenstern expected utility of a risk occurring or not)

- It is important to define the *analysis period*, whereas risk levels may change with time and the notion of likelihood is time-dependent (although rarely done in reality)

cause ⇒ *event* ⇒ negative effects ⇒ impact

1.1 Does the analysis include the risks mentioned in the GAF?

(Another example – risks from Annex III of Commission Implementing Regulation (EU) 2015/207)

Demand risks:

(i) Traffic forecasts different than predicted

Design risks:

(ii) Inadequate site surveys and investigation

(iii) Inadequate design cost estimates

Administrative and procurement risks:

(iv) Procedural delays

(v) Building permits

(vi) Utility approvals

Land acquisition risks:

(vii) Land costs higher than predicted

(viii) Procedural delays

Construction risks:

(ix) Project cost overruns

(x) Flooding, landslides, etc.

(xi) Archaeological findings

(xii) Contractor related (bankruptcy, lack of resources)

Operational risks:

(xiii) Operation and maintenance costs higher than expected

Financial risks:

(xiv) Tolls collection lower than expected

Regulatory risks:

(xv) Changes in environmental requirements

Other risks:

(xvi) Public opposition

1.2 Are the possible '*causes of failure*' identified for each risk?

- The causes for the occurrence of each risk must be thoroughly identified

1.3 Are the *negative effects* (impacts) on the project identified for each risk?

- The analysis must specify in detail the negative effects of the occurrence of each risk

1.4 Are likelihood and impact levels explicitly defined?

Example from section 2.9.2 of the Guide to cost benefit analysis of investment projects (2014)

A. Very unlikely (0–10 % probability)

B. Unlikely (10–33 % probability)

C. About as likely as not (33–66 % probability)

D. Likely (66–90 % probability)

E. Very likely (90–100 % probability)

Table 2.14 Risk severity classification.

Rating	Meaning
I	No relevant effect on social welfare, even without remedial actions.
II	Minor loss of the social welfare generated by the project, minimally affecting the project long run effects- However, remedial or corrective actions are needed.
III	Moderate: social welfare loss generated by the project, mostly financial damage, even in the medium-long run. Remedial actions may correct the problem.
IV	Critical: High social welfare loss generated by the project; the occurrence of the risk causes a loss of the primary function(s) of the project. Remedial actions, even large in scope, are not enough to avoid serious damage.
V	Catastrophic: Project failure that may result in serious or even total loss of the project functions. Main project effects in the medium-long term do not materialise.

1.5 Are levels of probability and severity of impact shown for each risk?

- The likelihood and impact levels need to be recorded for all risks. They must be in accordance with the adopted scales

1.6 Are the resulting *risk levels* shown for each risk?

- As a result of combining the likelihood and impact levels, risk levels must be determined for all risks

1.7 Are *prevention and mitigation measures* identified for each risk?

- Mitigation measures must be formulated for all *significant risks*

1.8 Are the levels of *residual risk* shown for each risk?

- The levels of risk *after* execution of the mitigation measures must be determined

1.9 Is there an interpretation of the risk matrix included?

- The analysis should include a summary of the significant risks, as well as interpretation
- There needs to be explanations how the mitigation measures affect the likelihood and/or impact levels for each risk, as well as how they lead to the determined residual risk levels

2.1 How are the levels of *likelihood* determined for the risks?

- Very often the likelihood levels are determined through "*expert opinion*"
- This is not a good approach, because humans are *bad "intuitive statisticians"* – see for example Kahneman, D., (2011), *Thinking Fast and Slow*
- It is highly recommended to determine likelihood levels based on observed *frequencies* of occurrence of the risks
- If statistical information is not available, it is recommended that likelihoods are determined by comparing risks with *one another* (i.e. comparison of the likelihood levels of all possible risk pairs)

2.2 How are the *severity of impact* levels determined for the risks?

- The impact level of a risk depends on the values and objectives of the evaluators, i.e. it is subject to *multi-criteria analysis* (or even cost-benefit analysis)
- Risks must be *mutually independent*
- The analysis must distinguish between *risks* and their *effects*
- It is highly recommended that the different impact evaluation criteria ("impact categories") are *quantitatively determined*
- The impact evaluation criteria must also be *mutually independent*
- It is extremely important to define the *strength of occurrence* of each risk, because the impact depends directly on it

Examples

Criteria for evaluation of risk impacts

Example 1:

- Impact on the welfare of society
- Negative social impacts
- Impact on employer's reputation

The term "welfare" in principle captures all effects that need to be considered, however it cannot be evaluated directly. It is unclear what "social impacts" are, hence they cannot be properly evaluated. Employer's reputation is not of value to the society.

Examples

Criteria for evaluation of risk impacts

Example 2:

- Direct monetary losses for the state
- Material losses (measured in terms of direct repair costs)
- Direct costs for emergency response
- Increased accident rates (in terms of impact and frequency of accidents)
- Economic costs of lost time
- Increased operation costs
- Loss of forests / agricultural land / habitats, etc.

😐

The main negative effects are identified, but it is not clarified how they compare against each other (especially monetary vs. non-monetary).

Examples

Criteria for evaluation of risk impacts

Example 3:

- Costs for repair of pavement structure
- Costs for repair of big structures
- Costs for repair of culverts
- Costs for repair of road signaling
- Other costs
- Time for execution of the repairs

😐

The negative effects are specific and can be quantified. However, it is unclear how to compare monetary vs. time effects. A problem is that the analysis is focused on the effects on the administration, but the effects on the users and general public are ignored.

Examples

Criteria for evaluation of risk impacts

Example 4:

- Reduction of the economic benefits of the project
- Negative effects on the components of the environment

☺

By evaluation using CBA of the impact of risks on the economic performance of the project all significant impacts are captured – on infrastructure, users, general public, etc. The analysis becomes complete with the introduction of an assessment of the environmental impacts of the project-related risks (needs to be done separately for the environmental components).

Examples

Dependent definitions of risks and their effects

Example 1:

- Lower GDP than forecasted
- Too optimistic transport demand forecast
- Timesavings lower than forecasted

Lower GDP could lead to lower mobility (i.e. lower traffic), which could lead to lower timesavings. The definitions are clearly dependent, and each risk in the chain is a consequence of the occurrence of the previous one.

Examples

Dependent definitions of risks and their effects

Example 2:

- Delays of land acquisition procedures
- Increased time for completion of the works
- Increased works contract price

Delayed land acquisitions can lead to increased time for completion and increased contract price. The increased time for completion could lead to increased contract price and (marginal) reduction of economic benefits, due to their postponement

Examples

Strength of risks

Example 1:

- Public procurement delays

A delay of e.g. 1 month is unlikely to be of significance; a delay of 1 year may lead to loss of co-financing.

Example 2:

- Public procurement delays of more than 6 months

Examples

Strength of risks

Example 3:

- Increased construction costs

An increase within the amount for contingencies will somewhat reduce the economic benefits of the project, but is unlikely to be a significant problem.
An increase above the amount for contingencies may result in inability to finance the project further.
Finally, an increase above the *switching value* of the CBA will make the project unfeasible and is a critical problem.

Examples

Strength of risks

Example 3:

- Increased contract price within the amount for contingencies
- Increased contract price above the amount for contingencies, but below the CBA switching value
- Increased contract price above the CBA switching value

☺

Taking into account the strength of occurrence of the risk allows to capture and evaluate *qualitatively* different impacts. For example, for the first risk the level of impact would be low, for the second it would be significant, and for the last – catastrophic.

Examples

General and ambiguous definitions
Incomplete set of risks
Dependent risks and mixing up risks and their effects
Unclear strength of occurrence of the risks
Undefined analysis period

Demand risks:

(i) Traffic forecasts different than predicted

Design risks:

(ii) Inadequate site surveys and investigation

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(xv) Changes in environmental requirements

Other risks:

(xvi) Public opposition

2.3 Are the *negative effects* of risks determined correctly and in sufficient detail?

- In the worst case – when the impacts are poorly evaluated – at least the negative effects must be properly identified

2.4 Are the results of the Climate Change Vulnerability and Risk Assessment *integrated* in the analysis?

- The GAF does not require this ("climate risks addressed in section 30"), but it makes sense to include the results of the CC VRA either in summarized form or (better) as a separate group of risks
- Both analyses need to be compatible, i.e. to use the same likelihood and impact scales.

2.5 Does the likelihood vs. impact scale appear unbiased (e.g. not too optimistic)?

- It is recommended to work with 3 risk levels
- The risk matrix must be unambiguously defined
- The scale must ensure *weak consistency* between the risk levels and the quantitative interpretation

Risk level	Colour
Low	
Moderate	
High	
Unacceptable	

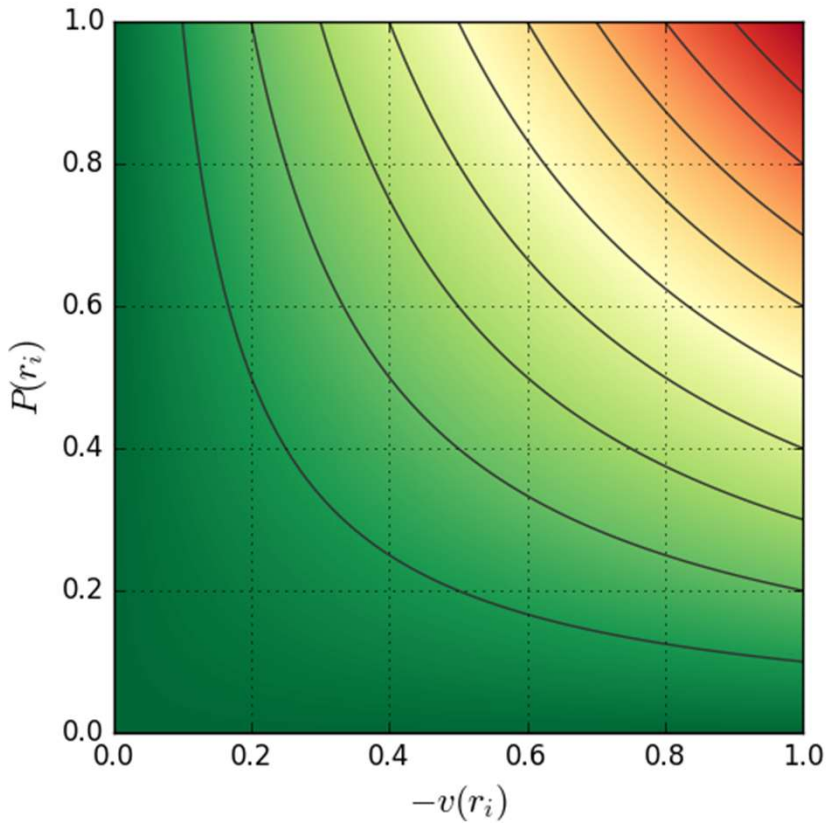
Severity / Probability	I	II	III	IV	V
A	Low	Low	Low	Low	Moderate
B	Low	Low	Moderate	Moderate	High
C	Low	Moderate	Moderate	High	High
D	Low	Moderate	High	Very High	Very High
E	Moderate	High	Very High	Very High	Very High

2.6 Are risk levels determined correctly in accordance with the risk matrix?

- I.e. if the calculations are correct…

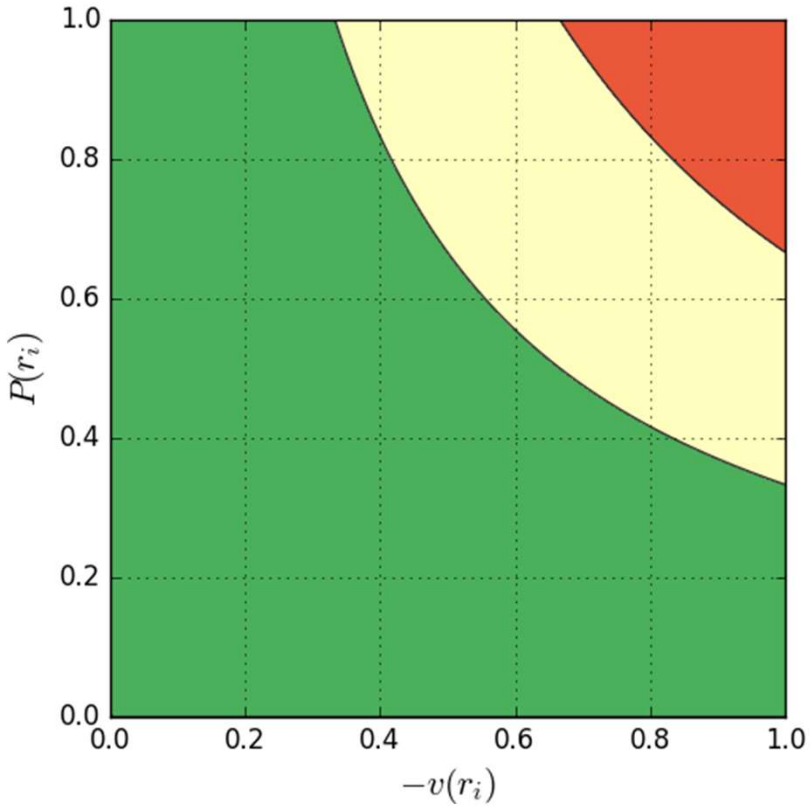
Examples

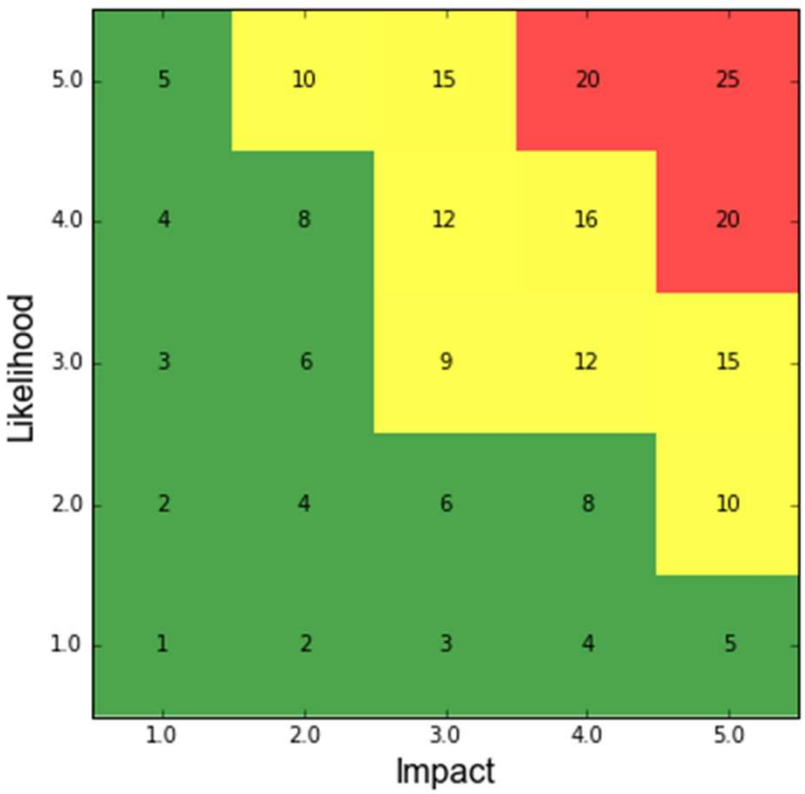
Geometric interpretation of risk levels
A continuous risk space with risk isolines



Examples

Geometric interpretation of risk levels
Discrete risk spaces





2.7 Are *mitigation measures* reasonable and realistic?

2.8 Are the *entities* responsible for mitigation properly identified?

2.9 Is there a detailed and realistic *implementation plan* for the mitigation measures?

- Perhaps the most important part of the analysis is the identification of *measures to avoid risks and/or mitigate their impacts*
- The measures must be detailed and specific in terms of *scope, responsible entities, time and budget*
- The responsible entities must have the *duty to implement the measures*
- *Following up of the implementation* of the plan must be ensured

Examples

Measures to avoid risks and/or mitigate their impacts

Example 1:

- Risk – public opposition
- Responsible – Employer, Contractor
- Measures – improved communication between the Employer and the Contractor
- Period – permanent

Too general definition of the measure, and it is not demonstrated how it would actually help. Also, it is unclear if the entities mentioned indeed have the responsibility to implement the measure.

Examples

Measures to avoid risks and/or mitigate their impacts

Example 2:

- Risk – public opposition
- Responsible – PIU, Public Relations Department, Engineer, Contractor
- Measures:
  - Establishment of a project monitoring committee with appropriate stakeholders. PIU to prepare order of appointment and send invitations to municipalities, NGOs, etc. by XX.XX.2023
  - Conduct coordination meetings between Engineer, Contractor and local authorities every 2 months (duty included in chapter X of the Employer's Requirements and Engineer's ToR)
  - Publishing monthly summaries of the progress of the Works on Employer's webpage (duty included in the Internal rules and procedures of the Public Relations Department)
  - Preparation and execution of a Publicity Action Plan by the Contractor (duty included in chapter Y of the Employer's Requirements)

2.10 Do *residual risks* appear correctly determined?

2.11 Are there any significant residual risks left after mitigation?

- Verification whether the residual risk levels actually reflect the consequences of the mitigation measures
- Verification whether there are significant residual risks – there must be none

Lunch break