Risk Assessment in the CBA process

Bruxelles, 30/9/2015
Antonio Carrarini
JASPERS - Vienna Office
Overview

- Reg. (EU) 1303/2013 ("Common provisions on the ERDF") includes general **requirements related to risk**
  - In the OP
  - In the **CBA**
  - In the financing plan
  - Etc.

- **Aims** of risk assessment
  - Avoid (later) failures and bad outcomes
  - Avoid (later) troubles, e.g. cost overruns
  - Increase efficiency of process by making risk "visible"
  - Increase effectiveness of measures/projects
Overview (II)

Risk assessment in programming and in applications

Current/past practice
- Lack of confidence in Risk Assessment
- Uncertainty on how to apply Risk Assessment in practice
- Limited availability of guidance/resources on Risk Assessment
- Poor added value of RA to the decision process

Best practice
- Understanding of rationale behind Risk Assessment
- Understanding of mechanisms behind Risk Assessment
- Identification of needs for further knowledge/capacities on Risk Assessment
- Risk Assessment as a decision driver
HS2 economic case downgraded but benefits still outweigh costs, says DfT

Expected benefit-cost ratio for proposed network falls from £2.50 for every pound spent to £2.30 in new analysis

Gwyn Topham, transport correspondent
Tuesday 29 October 2013 12.28 GMT

Source: The Guardian
HS2

High speed rail scheme criticised for large budget and ‘lack of clear plan’

Public accounts committee chair, Margaret Hodge, doubts value to taxpayer, given ‘DfT overspends and benefits unproven’

A Stop HS2 poster erected in 2013 in Pickmere, Cheshire, near the proposed new rail line. Photograph: Christopher Thomond for the Guardian

Source: The Guardian

Gwyn Topham, transport correspondent

Friday 16 January 2015 00.01 GMT
The UK government has published the fifth installment of the strategic case for High Speed 2. The changes to the cost-benefit analysis are summarised below:

### Figure 5.7: Standard appraisal – changes to costs and benefits (over 60 years)

<table>
<thead>
<tr>
<th></th>
<th>Phase One</th>
<th></th>
<th>Full Network</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport benefits (Business)</td>
<td>12,566</td>
<td>16,921</td>
<td>34,292</td>
<td>40,529</td>
</tr>
<tr>
<td>Transport benefits (Other)</td>
<td>7,198</td>
<td>7,673</td>
<td>16,742</td>
<td>19,323</td>
</tr>
<tr>
<td>Other quantifiable benefits</td>
<td>793</td>
<td>407</td>
<td>1,046</td>
<td>788</td>
</tr>
<tr>
<td>Indirect taxes (loss to Govt)</td>
<td>-1,587</td>
<td>-1,208</td>
<td>-3,831</td>
<td>-2,912</td>
</tr>
<tr>
<td><strong>Net transport benefits</strong></td>
<td>18,770</td>
<td>23,793</td>
<td>48,250</td>
<td>57,727</td>
</tr>
<tr>
<td>Wider economic impacts</td>
<td>4,849</td>
<td>4,341</td>
<td>15,377</td>
<td>13,293</td>
</tr>
<tr>
<td>Total costs</td>
<td>26,942</td>
<td>29,919</td>
<td>58,672</td>
<td>62,606</td>
</tr>
<tr>
<td>Revenues</td>
<td>13,189</td>
<td>13,243</td>
<td>32,938</td>
<td>31,111</td>
</tr>
<tr>
<td><strong>Net cost to Government</strong></td>
<td>13,753</td>
<td>16,676</td>
<td>25,734</td>
<td>31,495</td>
</tr>
<tr>
<td>Benefit cost ratio (inc WEIs)</td>
<td>1.7</td>
<td>1.7</td>
<td>2.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Spain's Ciudad Real airport sold at auction for €10,000

18 July 2015 | Europe

A group of international investors has won a bankruptcy auction for an abandoned airport in central Spain with a €10,000 (£7,000) offer - 100,000 times less than it cost to build.

Source: BBC
A report published today by the European Court of Auditors (ECA) reveals that EU-funded investments in airports have not generated the expected results and have produced poor value for money. Due to a lack of adequate planning and forecasting, say EU auditors, some of the funded airports were situated too close to one another, while some of the construction projects were too big for the numbers of planes and passengers involved.

“We found that some airports were not profitable in the long term, some were underused and some were not used at all,” commented George Pufan, the ECA Member responsible. “European air traffic is set to double by 2030. If Europe is going to meet this extra demand, both the Commission and the Member States must improve the way they invest in our airports by funding only those which are profitable and for which there is a real investment need.”

The EU auditors examined investment projects at 20 airports – in Estonia, Greece, Italy, Poland and Spain – which received more than €600 million of EU money from 2000 to 2013. The auditors found that only half of these airports could show the need for EU-funded investment and that funded infrastructure was often underused, with some €38 million worth not being used at all.
Spain to rescue empty toll roads in deal avoiding deficit hit

Real life
Bürgerumfrage in Stuttgart

Stuttgart 21 spaltet weiter die Stadt

Von Jörg Nauke 01. September 2015 - 05:00 Uhr

Stuttgart 21 ist weiterhin ein umstrittenes Thema in der Stadt. Das zeigen die Ergebnisse der aktuellen Bürgerumfrage, die am Montag vorgestellt wurden. Noch skeptischer wird nur das Einkaufszentrum Milaneo gesehen.

Das Meinungsbild zu Stuttgart 21 ist positiver als noch vor zwei Jahren. Dennoch ist der Wert von 50 Punkten im Kommunalbarometer kein guter.

Foto: Lichtgut/Leif Piechowski

Source: Stuttgarter Zeitung
Stuttgart 21

Neue Kosten-Nutzen-Rechnung gefordert

Von SIR/dpa 02. Januar 2015 - 17:00 Uhr


Zu Stuttgart 21 soll eine neue Kosten-Nutzen-Rechnung her.
Foto: dpa

Source: Stuttgarter Zeitung
Il costo della Torino-Lione resterà “blindato” a 8,2 miliardi

di Filomena Greco   12 giugno 2015


Il costo complessivo, suddiviso tra sei miliardi e mezzo per le opere civili e 1,6 miliardi per gli allestimenti tecnologici, si riferisce alla realizzazione dei 57 chilometri di tunnel

Source: Sole 24 Ore
Il no alla Tav Torino-Lione? Costa due miliardi

Maria Chiara Voci 10 marzo 2013

Le cifre esatte ancora non si conoscono e le stime cambiano a seconda di chi le dà. È dunque complicato, ad oggi, calcolare con precisione quanto possa costare all'Italia l'eventuale abbandono - e questa volta per sempre - del progetto della linea ferroviaria ad alta velocità Torino-Lione.

Il Movimento 5 Stelle, che in Valsusa ha raggiunto medie di gradimento intorno al 40%, di gran lunga superiori ad altri territori d'Italia (segno che, nonostante quanto afferma parte della politica, la gran parte della popolazione locale resta fortemente contraria alla Tav), lo ha annunciato chiaro e tondo. E lo ribadirà con la partecipazione alla grande manifestazione organizzata a Torino dal 5 Stelle. URL della risposta completa di Maria Chiara Voci a questo articolo.
Real life

Continued rail disruption certain without urgent action, says report

Infrastructure is too weak for extreme weather caused by climate change, transport review finds

Jonathan Owen | Sunday 24 August 2014 00:00 BST | 9 comments

Source: The Independent
ÜBERSCHWEMMUNGEN

Das Hochwasser behindert den Bahnverkehr nach Berlin

Die Bahntrasse bei Schönhausen (Sachsen-Anhalt) ist vom Hochwasser der Elbe überflutet. Die Sperrung der ICE-Strecke sorgt weiter für Verspätungen im Fernbahnverkehr.

Foto: Christian Charisius / dpa

Source: Berliner Morgenpost
The nature of risk

<table>
<thead>
<tr>
<th>Categories of risk (see next slides):</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Technical” risk (Project /Design /Construction /etc.)</td>
</tr>
<tr>
<td>Environmental /Climate change (cp. SEA/EIA)</td>
</tr>
<tr>
<td>Financial</td>
</tr>
<tr>
<td>Administrative</td>
</tr>
<tr>
<td>Other risks (political, social, etc.)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sources of risk:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic uncertainty</td>
</tr>
<tr>
<td>Changes (also over time)</td>
</tr>
<tr>
<td>Bias</td>
</tr>
<tr>
<td>Ignorance (lack of resources)</td>
</tr>
<tr>
<td>Bad practice (lack of Risk Management)</td>
</tr>
<tr>
<td>Etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (e.g. costs, delays) → prevention possible</td>
</tr>
<tr>
<td>External (e.g. demand, climate change, politics) → only mitigation possible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effects of risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing targets and goals</td>
</tr>
<tr>
<td>Cost overrun</td>
</tr>
<tr>
<td>Negative impacts on environment and society</td>
</tr>
<tr>
<td>Total failure</td>
</tr>
<tr>
<td>Etc.</td>
</tr>
</tbody>
</table>

Understanding Risk significantly benefits the assessment!
Typical risk categories

- Typical risks in transport (Cp. CBA Guideline)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory</td>
<td>Changes in environmental requirements</td>
</tr>
<tr>
<td>Demand analysis</td>
<td>Traffic forecasts different than predicted</td>
</tr>
<tr>
<td>Design</td>
<td>Inadequate site surveys and investigation</td>
</tr>
<tr>
<td></td>
<td>Inadequate design cost estimates</td>
</tr>
<tr>
<td>Administrative</td>
<td>Building permits</td>
</tr>
<tr>
<td></td>
<td>Utility approvals</td>
</tr>
<tr>
<td>Land acquisition</td>
<td>Land costs higher than predicted</td>
</tr>
<tr>
<td></td>
<td>Procedural delays</td>
</tr>
<tr>
<td>Procurement</td>
<td>Procedural delays</td>
</tr>
<tr>
<td>Construction</td>
<td>Project cost overruns</td>
</tr>
<tr>
<td></td>
<td>Flooding, landslides, etc.</td>
</tr>
<tr>
<td></td>
<td>Archaeological findings</td>
</tr>
<tr>
<td></td>
<td>Contractor related (bankruptcy, lack of resources)</td>
</tr>
<tr>
<td>Operation &amp; Financial</td>
<td>Tolls collection lower than expected</td>
</tr>
<tr>
<td>Other</td>
<td>O&amp;M costs higher than expected</td>
</tr>
<tr>
<td></td>
<td>Public opposition</td>
</tr>
</tbody>
</table>
Typical risk categories (II)


- 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
The risk assessment process

- Main steps of risk assessment

1. **Sensitivity** analysis - Where/Which

2. **Qualitative** risk analysis - How

3. **Quantitative** risk analysis - How much

4. Inclusion of risk **prevention and mitigation** measures - What

5. Inclusion into **decision process** - Why (feasibility studies, assessment, etc.)
The risk assessment process

- Main steps of risk assessment
  1. **Sensitivity** analysis
  2. **Qualitative** risk analysis
  3. **Quantitative** risk analysis
  4. Inclusion of risk **prevention and mitigation** measures
  5. Inclusion into **decision process** (feasibility studies, assessment, etc.)
1. Sensitivity Analysis

- **Sensitivity** = *Influence* ("Where/Which")
- **Sensitivity analysis** = *Find the issues which are most influential (both to the project and to the analysis process)*

- **Examples**
  - Forecasts parameters (socio-demographic, economic, etc.)
  - Cost estimates (e.g. unit values!)
  - Pollution levels
  - Etc.

- **Good for**
  - Quick overview of potential problems *(NO input/statistical detail required!)*
  - Determine need for more detailed preliminary analysis
1. Sensitivity Analysis

- **Methods** for sensitivity analysis:
  - Elasticity analysis ("leverage effect": 1% change in input → X% change in output)
  - Switching values (value needed to have NPV=0)
  - Scenario Analysis
  - Etc.

- Typically most critical/influential **variables** (Cp. CBA Guideline):
  - value of time
  - accident costs
  - assumptions on GDP and other economic variables trend
  - rate of increase of traffic over time
  - number of years necessary for the realisation of the infrastructure
  - investment and maintenance costs (as disaggregated as possible)
  - fare/tariff/toll
1. Sensitivity Analysis

- Example of elasticity analysis (Cp. CBA Guideline)

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Variation of ENPV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+1 % of variable</td>
</tr>
<tr>
<td>Investment costs</td>
<td>-1.01 %</td>
</tr>
<tr>
<td>Maintenance costs</td>
<td>-0.02 %</td>
</tr>
<tr>
<td>Baseline traffic (without project)</td>
<td>1.3 %</td>
</tr>
<tr>
<td>Incremental traffic (induced by project)</td>
<td>0.2 %</td>
</tr>
<tr>
<td>Time savings</td>
<td>1.03 %</td>
</tr>
<tr>
<td>Savings of road VOC</td>
<td></td>
</tr>
<tr>
<td>Accident savings</td>
<td>0.5 %</td>
</tr>
<tr>
<td>Externalities</td>
<td></td>
</tr>
<tr>
<td>TOC savings</td>
<td>0.10 %</td>
</tr>
</tbody>
</table>
1. Sensitivity Analysis

- Example of **switching values** (Cp. CBA Guideline)

<table>
<thead>
<tr>
<th>CRITICAL VARIABLES</th>
<th>Value for which ENPV = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment cost</td>
<td>161 %</td>
</tr>
<tr>
<td>Baseline traffic</td>
<td>-36 %</td>
</tr>
<tr>
<td>Time savings</td>
<td>-77 %</td>
</tr>
</tbody>
</table>

Your opinion?
2. Qualitative Risk Analysis

- Qualitative = non-numerical, characteristic ("How")
- Qualitative Risk Analysis = Examine the potential sources, mechanisms and effects of risk

Examples

- Fundamental effect of influential parameters (cp. Sensitivity Analysis)
- Effect of external (exogenous) influences
- Effect of non-quantifiable effects (Political / legal / administrative constraints like consensus, permissions, limits, etc.)
- Etc.

Good for

- Backbone of the risk assessment (it actually is THE risk analysis)
- Basis for decision making (see point 5.)
2. Qualitative Risk Analysis

- **Steps of Qualitative Risk Analysis:**
  a) Identify adverse events
  b) Set up a risk matrix (see next slide)
  event → causes → effects → risk level → countermeasures → residual risk
  c) Interpret the risk matrix
  d) Prepare identification of prevention/mitigation measures

- **Risk level**

  
  \[ \text{Difficult to assess} \quad \Rightarrow \quad \text{Probability of occurrence} \times \text{Severity of outcome (impact)} \]

<table>
<thead>
<tr>
<th>(\text{Very low probab. (A)})</th>
<th>(\text{Low severity (I)})</th>
<th>(\text{Low severity (II)})</th>
<th>(\text{Mid severity (III)})</th>
<th>(\text{High severity (IV)})</th>
<th>(\text{Very high severity (V)})</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Very low severity (I)</strong></td>
<td>(\text{Low risk})</td>
<td>(\text{Moderate risk})</td>
<td>(\text{High Risk})</td>
<td>(\text{Very high Risk})</td>
<td></td>
</tr>
<tr>
<td><strong>Low probab. (B)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mid probab. (C)</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>High probab. (D)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Very high probab. (E)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Qualitative Risk Analysis

- Example of risk matrix (Cp. CBA Guideline)

<table>
<thead>
<tr>
<th>Adverse event</th>
<th>Variable</th>
<th>Causes</th>
<th>Effect</th>
<th>Timing</th>
<th>Effect on cash flows</th>
<th>Probability (P)</th>
<th>Severity (S)</th>
<th>Risk Level</th>
<th>Prevention and/or Mitigation measures</th>
<th>Residual risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction delays</td>
<td>Investment cost</td>
<td>Low contract</td>
<td>No effect</td>
<td>Short-term</td>
<td>Low effect on cash flows</td>
<td>Low probability</td>
<td>Low severity</td>
<td>Low risk</td>
<td>Set up of a Project Implementation Unit to be assisted by technical assistance for project management during implementation.</td>
<td>Low residual risk</td>
</tr>
<tr>
<td>Project cost overrun</td>
<td></td>
<td></td>
<td>No effect</td>
<td>Short-term</td>
<td>Low effect on cash flows</td>
<td>Low probability</td>
<td>Low severity</td>
<td>Low risk</td>
<td>Set up of a Project Implementation Unit to be assisted by technical assistance for project management during implementation.</td>
<td>Low residual risk</td>
</tr>
<tr>
<td>Late delivery of project</td>
<td></td>
<td></td>
<td>No effect</td>
<td>Short-term</td>
<td>Low effect on cash flows</td>
<td>Low probability</td>
<td>Low severity</td>
<td>Low risk</td>
<td>Set up of a Project Implementation Unit to be assisted by technical assistance for project management during implementation.</td>
<td>Low residual risk</td>
</tr>
<tr>
<td>Delays in obtaining permits</td>
<td>Not applicable</td>
<td></td>
<td>No effect</td>
<td>Short-term</td>
<td>Low effect on cash flows</td>
<td>Low probability</td>
<td>Low severity</td>
<td>Low risk</td>
<td>Set up of a Project Implementation Unit to be assisted by technical assistance for project management during implementation.</td>
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</tr>
<tr>
<td>Public opposition</td>
<td></td>
<td></td>
<td>No effect</td>
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<td>Low effect on cash flows</td>
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<td>Set up of a Project Implementation Unit to be assisted by technical assistance for project management during implementation.</td>
<td>Low residual risk</td>
</tr>
</tbody>
</table>

See Step 4
2. Qualitative Risk Analysis

- **In practice:**
  - **Identification of risk and risk sources:**
    - Start from standard risk tables and experience in the transport sector
    - Screen the specific issues and the specific context of the project(s) in question
    - Screen all involved actors (as a source or a “victim” of risk)
    - Screen all involved processes (design, authorization, construction, operation, etc.)
    - Etc.

- **Quantification of risk**
  - Estimate probability and impact realistically or conservatively, NOT optimistically
  - Estimate probability by own past experiences, international sectorial experiences, expert opinion, etc.
  - Estimate impacts by analyzing cause/effects relationships and deducting the outcome (reduce assumptions to a minimum)
  - If estimation of impacts very imprecise, build scenarios (optimistic, pessimistic) to gain overview and show the full range of risk to the decision makers
2. Qualitative Risk Analysis

Common mistakes related to the probability of occurrence

- "It might happen", "It’s a Fifty-Fifty case"
  - Resulting risk level is medium-high, not low! (cp. matrix)

- "High impacts can be relativized"
  - High impacts always lead to high risk level and are unacceptable! In turn, low impacts offer the best protection against risk. (cp. matrix)

- "I do not know"
  - This does not mean that probability is 50%! More analysis is required!

- "It has never happened"
  - Invalid criterion, risk level can be nonetheless high! (Not to be confused with return period/recurrence interval method)
2. Qualitative Risk Analysis

- **Example of risk: demand risk**
  - Adverse event: lower demand than expected
  - Effect: economic case not fulfilled

- **Estimation of demand risk**
  - **Probability**
    - *Directly* dependent on: demographic and economic trends, land development, etc.
    - *Indirectly* dependent on: development of competitive modes, construction of competitive/parallel projects, other external factors (e.g. demand on an airport link), etc.
    - → Fundamental variables/events to be examined
  - **Effects**
    - Use transport model to assess effects of variations in the fundamental variables on demand
    - If not possible, use simplified models or other reasoning
    - If all goes wrong, make conservative assumptions (e.g. Probability > 50%)
3. Quantitative risk analysis

- Quantitative = *numerical, measurable* (“How much”)
- Quantitative risk analysis = Compute the amount of risk

**Examples**
- Highly variable parameters (e.g. demand!)
- Highly relevant but not well predictable parameters (e.g. unit costs)

**Good for**
- Analysis of highly sensitive issues when expected risk/impact is high (as long as sufficient statistical specification of the parameters is available)
- Analysis of complex interaction of variables (e.g. combined variations in investment costs and demand)
- Analysis of highly uncertain issues
3. Quantitative risk analysis

- **Approach**
  - Strictly related to sensitivity analysis
  - Mainly used for numerical parameters: costs (esp. unit costs), forecasts, parameters (VoT), etc.
  - Also possible for qualitative aspects
  - Risk must be quantifiable (not possible or sensible for certain qualitative aspects)

- **Methods**
  - Probabilistic risk analysis (“Monte Carlo”)
  - Other methods (advanced and complex → not sensible as the quality of input data is typically low)
4. Risk prevention and mitigation

- **Prevention** = Reduce *probability* of occurrence
- **Mitigation** = Reduce amount of potential *damage*

Risk level = Probability of occurrence $\times$ Severity of outcome (impact)

**Approach**

- Strictly related to Qualitative Risk Analysis
- Measures for prevention and mitigation must be justified (targeted, efficient, effective)
- Risk must be sensibly covered, otherwise no-go
- Rely on past experiences
- Set up a risk management system (including risk manager)
- Seek expert advice if risk not well manageable or risk high
5. Inclusion into the process

- **Main steps**

  1. **Sensitivity** analysis
  2. **Qualitative** risk analysis
  3. **Quantitative** risk analysis
  4. Inclusion of risk **prevention and mitigation** measures
  5. Inclusion into **decision process** (feasibility studies, assessment, etc.)
5. Inclusion into the process

Feasibility Study*

Definition of Task/Targets

Option 1 | Option 2 | Option n
---|---|---
Risk | Risk | Risk

Assessment of options

Preferred option(s)

CBA + Full Risk Analysis

Final option (+ prevention/mitigation measures)

Risk assess.

1. Sensitivity Analysis
2. Qualitative Analysis
3. Quantitative Analysis
4. Prevention and mitigation measures

* Simplified representation. CBA is not necessarily part of the Feasibility Study
5. Inclusion into the process

- Risk assessment starts when defining transport strategies
  - Include management of strategic/political/financial risk (project-independent)
  - Identify fundamental risks at an early stage

- Feasibility studies / CBA
  - Identification of solutions / assessment of options
    - Include risk as an assessment criterion for options (simplified qualitative risk assessment)
    - Take rough estimates of effort for prevention/mitigation of each option into account in the assessment

- Assessment of project
  - Carry out in-depth, complete risk assessment and set up prevention/mitigation plan
  - Kill project if unbearable/non-manageable risk, re-assess options
5. Inclusion into the process

- **Costs of risk**
  - Costs of prevention/mitigation measures to be included into the investment and/or O&M costs (CBA, financial plan, etc.)
  - Costs of risk management also to be included in the financial plan

- **Implementation**
  - Prevention/mitigation measures to be included into implementation plan
  - Potential delays/additional costs/etc. to be taken into account (safety buffers, reaction plan, fault tree analysis, etc.)
  - Risk management to cover the entire project life (incl. construction phase)
Conclusions

Do not think of Risk Assessment as:

- an “Add On” or a final step
  → It is an integral part of the CBA process, from the very beginning

- an unnecessary, formal burden
  → It is the best method to systematically identify and avoid pitfalls and problems at the earliest stage

- something bad or negative
  → Call it “Success Assessment”?
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