Risk in Front End Working group

Ivana Burcar Dunović

Content

+ Introduction and methodology
+ Literature review
+ Case analysis
+ EC practice
Group members

+ Members
  - Milen Baltov – Bulgaria
  - Rafaela Alfalla-Luque – Spain
  - Miljan Mikic – Serbia
  - Joao Abreu E Silva – Portugal
  - Marisa Pedro – Portugal
  - Alex Stamov – Bulgaria
  - Konrad Spang – Germany
  - Vit Hromadka – Czech Republic
  - Zhen Chen – UK

+ Supporting Members
  - Alvaro Cazorla – Spain
  - Ana Irimia Dieguez – Spain
  - Jana Korytarova – Czech Republic
  - Alison Hood – UK
  - Aldo Gebbia – Italy
  - Mladen Radujković - Croatia
  - Nigel Smith – UK
  - Marco Kuemmerle – Germany
  - Camelia Michaela Kovacz – Belgium

+ WG Leader
  - Ivana Burcar Dunović - Croatia
Where we come from?

+ WG idea resulted from a joint interest
  – Transportation and WG
  – Cross Sectorial WG.

+ Both working groups looked at issues related with risks associated beyond not just with budget and schedule

+ when should the different risks should be considered and managed
Initiation in MC Meeting in Dubrovnik

- 30th September 2013,

resulting with proposing following aims:
- to do review on the literature about risks in megaprojects
- To identify the main issues in common experience in the MEGAPROJECT portfolio of risks in megaprojects
- To clarify the different between risk identification at the front end of the megaprojects and the risk at the front end of the projects as a whole?
- To demonstrate the possible ways of dealing with risk in the evaluation of megaprojects in the front-end
Working group meetings

+ It was followed by working meetings in
  – Brno (14th February 2014.),
  – Seminar - Megaproject Risk Assessment & Simulation – Edinburgh, 30.05.2014
  – Burgas (06th-07th July 2014.), + conference
  – Liverpool (11th-12th July 2014.),
  – Kassel (17th November 2015.) and
  – Zagreb (6th-7th February 2015)
Research questions

+ aims were refined into research questions which RFE WG aimed to answer:
  – What does current literature say about risks in megaprojects?
  – What is the common experience in the MEGAPROJECT portfolio of risks in megaprojects?
  – From the above, what is the different between risk and risk management in the front-end of megaprojects and risk and risk management in the front end of projects?
  – what is the difference between risk in the front-end of megaprojects and risk in the megaproject delivery?
  – What are possible ways of dealing with risk in the front-end evaluation of megaprojects?
Methodology

+ The first stage
  – current literature analysis to establish research gaps.
  – in three phases:
    1. general overview,
    2. bibliometric analysis of risk management in megaprojects, followed by bibliometric analysis aiming at identifying emerging topics and research gaps in risk management in projects and megaprojects.
    3. literature review aimed at clarify the meaning of term “risk in front end” analysing risk and uncertainty.
Methodology

+ The second stage - case analysis.
  - what is the common experience of risk in megaprojects;
  - how the risk has been managed in different megaproject case studies and develop some theoretical framework.
  - 9 cases were studied using questionnaire that was designed within RFE Working group.
  - The questionnaire was used to conduct structured interviews with project managers,
    - data on project managers profile,
    - project data and
    - risk management data.
Large and megaproject front-end

+ is all about
  – ambiguity
  – uncertainty and risks
  – complexity
  – knowledge

+ **The level of uncertainty is extremely high because of**
  – the large number of potential sources of risk,
  – the projects’ visibility,
  – their innovativeness.
Literature review - Alvaro
management of this phase showed significantly more impact on project performance than engineering, procurement and construction phase.

Up to 33% of total budget.

Average duration is 7 years.

Essential to ensuring project success.

Extremely high level of ambiguity.
IMEC - lessons learned

+ The development of the project during the front-end phase
  – time-dependent,
  – non-linear,
  – and iterative process,
+ during which the project was formulated, tested, challenged, and reformulated through a series of episodes.
  – Unforeseen risks and issues emerge in successive episodes and must be managed
  – Each project encountered an average of 4 unforeseen and potentially catastrophic events during their long life cycles
Risk and uncertainty

+ difference between uncertainty and risk is ambiguous
+ analysis of definitions
+ risk can be viewed from two aspects –
  – **epistemological**, which includes people’s epistemological assumptions and project
  – **ontological**, which considers origin of uncertainty and risks.
Epistemological aspect

+ Chapman and Ward

+ Vose

+ Sanderson

<table>
<thead>
<tr>
<th>Risk Category 1: <em>a priori</em> probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Category 2: statistical probability</td>
</tr>
<tr>
<td>Uncertainty Category 1: subjective probability</td>
</tr>
<tr>
<td>Uncertainty Category 2: socialised</td>
</tr>
</tbody>
</table>
Defining uncertainty management

- Known knowns
  - Planning with variability
  - Management of variability

- Unknown unknowns
  - Management of lack of knowledge

- Known unknowns
  - Management of risks

Management of uncertainty
Ontological aspect
Ontological aspect

Atkinson et al. (2006), define three key-areas of uncertainty:

- uncertainty linked to *estimations* (of cost, schedule and demand);
- uncertainty associated with *project parties* (related to infrastructure management) and
- uncertainty regarding to *project lifecycle stages* (related with the failure of thoroughly carrying out the design and planning stages).
Chapman and Ward (2003a) present 5 areas:

- Variability associated with estimates
- Uncertainty about the basis of estimates
- Uncertainty about design and logistics
- Uncertainty about objectives and priorities
- Uncertainty about the fundamental relationships between project parties
Complexity

+ Previously in literature review on complexity, three types of relationship with uncertainty were identified:
  - Uncertainty and complexity are independent characteristics (Clegg *et al.* 2002), (van Marrewijk *et al.* 2008),
  - Complexity is compounded by uncertainty (Williams 2002) and increased with constraints (Burcar Dunović *et al.* 2014) - epistemological aspect
  - Project complexity is the source of uncertainty in project. (Danilovic and Browning 2007), (Secretariat 2007) - ontology of risks
# The questionnaire

<table>
<thead>
<tr>
<th>Respondent data</th>
<th>Project data</th>
<th>Risk management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Project type</td>
<td>RM maturity for delivering organisation</td>
</tr>
<tr>
<td>Age</td>
<td>Source of financing</td>
<td>RM methodology</td>
</tr>
<tr>
<td>Years of experience</td>
<td>Type of contracting</td>
<td>Focus of RM</td>
</tr>
<tr>
<td>Education or qualifications in risk management</td>
<td>Technology</td>
<td>Level of RM integration</td>
</tr>
<tr>
<td>Megaproject experience</td>
<td>Stage</td>
<td>Tools and techniques of RM</td>
</tr>
<tr>
<td></td>
<td>Success criteria</td>
<td>Parties involved</td>
</tr>
<tr>
<td></td>
<td>Main constraints</td>
<td>Risk owners</td>
</tr>
<tr>
<td></td>
<td>Critical success factors</td>
<td>RM documentation</td>
</tr>
<tr>
<td></td>
<td>Formal reviews</td>
<td>Major source of uncertainty in front-end</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk assessment in Feasibility study</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main components of risks and opportunities</td>
</tr>
</tbody>
</table>
## RFE Cases

<table>
<thead>
<tr>
<th>Mega project</th>
<th>Type Sector (1&lt;sup&gt;st&lt;/sup&gt; level)</th>
<th>Type Sector (2&lt;sup&gt;nd&lt;/sup&gt; level)</th>
<th>Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Utility Infrastructure</td>
<td>Oil and Gas</td>
<td>On-going (Operation)</td>
</tr>
<tr>
<td>2</td>
<td>Transport and Utility Infrastructure</td>
<td>Waterway, Water Management and Energy</td>
<td>On-going (Front-end)</td>
</tr>
<tr>
<td>3</td>
<td>Transport Infrastructure</td>
<td>Road and Rail</td>
<td>On-going (Operation)</td>
</tr>
<tr>
<td>4</td>
<td>Transport Infrastructure</td>
<td>Rail</td>
<td>On-going (Operation)</td>
</tr>
<tr>
<td>5</td>
<td>Cross-Sectorial</td>
<td>Commercial and Industrial Zones</td>
<td>On-going (Design, Construction, Operation)</td>
</tr>
<tr>
<td>6</td>
<td>Transport Infrastructure</td>
<td>Road</td>
<td>On-going (Operation)</td>
</tr>
<tr>
<td>7</td>
<td>Transport Infrastructure</td>
<td>Rail</td>
<td>On-going (Operation)</td>
</tr>
<tr>
<td>8</td>
<td>Transport Infrastructure</td>
<td>Rail</td>
<td>On-going (Construction and Operation)</td>
</tr>
<tr>
<td>9</td>
<td>Cross-Sectorial</td>
<td>R&amp;D Infrastructure</td>
<td>On-going (Design, Construction)</td>
</tr>
</tbody>
</table>
Respondents

+ Project Managers, Project Coordinators or Directors
+ in 67% cases is the first or second megaproject
+ in 88% have more than 10 years of experience

Education/qualifications in risk management (RM)

- International Certificate in RM: 11%
- MSc in RM: 0%
- PhD in RM: 0%
- RM was part of project management education: 33%
- Specialized RM course: 22%
- Other: 11%
- None: 22%
Status of on-going megaprojects

- Front-end: 11%
- Design: 22%
- Construction: 33%
- Operation: 78%

Project Type

- Cross Sectorial: 22%
- Utility Infrastr.: 11%
- Transport Infrastr.: 56%
- Mix: 11%
## Financing

<table>
<thead>
<tr>
<th>Most sources of financing</th>
<th>MP [#]</th>
<th>Frequency [%]</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Government budget</td>
<td>6</td>
<td>67%</td>
<td>23%</td>
</tr>
<tr>
<td>Regional budget</td>
<td>3</td>
<td>33%</td>
<td>5%</td>
</tr>
<tr>
<td>Development or investment bank</td>
<td>2</td>
<td>22%</td>
<td>12%</td>
</tr>
<tr>
<td>EU funds</td>
<td>6</td>
<td>67%</td>
<td>29%</td>
</tr>
<tr>
<td>Private investment</td>
<td>1</td>
<td>11%</td>
<td>3%</td>
</tr>
<tr>
<td>Public-private partnership</td>
<td>2</td>
<td>22%</td>
<td>15%</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>44%</td>
<td>13%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of contracting</th>
<th>MP [#]</th>
<th>Frequency [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design-Bid-Build</td>
<td>4</td>
<td>44%</td>
</tr>
<tr>
<td>Design-Build</td>
<td>2</td>
<td>22%</td>
</tr>
<tr>
<td>Design- Build-Operate</td>
<td>1</td>
<td>11%</td>
</tr>
<tr>
<td>EPC/Turn Key</td>
<td>2</td>
<td>22%</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>11%</td>
</tr>
</tbody>
</table>
Technology - innovation

- **Stable known/ Proven:** 22%
- **Known technology/ New application:** 56%
- **New technology/ Limited application:** 44%
- **Innovative/ Unproven:** 11%
RM maturity

+ 2.37 out of 5

- Context of the organisation / activity
- Involve all major stakeholders
- Clear objectives
- Policies, processes, strategies and methods
- Risk management reports
- Early warning indicators (EWIs)
- Central risk function
- Roles and responsibilities
- Barriers to implementation
- Review the effectiveness of processes
- Strategies for improving risk resilience
- Risk culture
RM maturity

Strategies for improving risk...
Risk culture
Barriers to implementation
Review the effectiveness of processes
Early warning indicators (EWIs)
Central risk function
Roles and responsibilities
Risk management reports
Policies, processes, strategies and...
Clear objectives
Involve all major stakeholders
Context of the organisation / activity

Level 1 (Initial)
Level 2 (Repeatable)
Level 3 (Defined)
Level 4 (Managed)
Level 5 (Optimising)
## Sources of uncertainty

<table>
<thead>
<tr>
<th>Sources of uncertainty</th>
<th>Average</th>
<th>Stand.dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Variability associated with estimates</td>
<td>3,21</td>
<td>0,55</td>
</tr>
<tr>
<td>2. Uncertainty about the basis of estimates</td>
<td>3,06</td>
<td>1,00</td>
</tr>
<tr>
<td>3. Uncertainty about design and logistics</td>
<td>2,78</td>
<td>0,44</td>
</tr>
<tr>
<td>4. Uncertainty about objectives and priorities</td>
<td>2,04</td>
<td>0,70</td>
</tr>
<tr>
<td>5. Uncertainty about fundamental relationships between project parties</td>
<td>2,91</td>
<td>0,86</td>
</tr>
<tr>
<td><strong>Average Total</strong></td>
<td>2,88</td>
<td>0,40</td>
</tr>
</tbody>
</table>
## Megaproject

<table>
<thead>
<tr>
<th>Sources of uncertainty</th>
<th>Average</th>
<th>Stand. dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Variability associated with estimates</td>
<td>3,21</td>
<td>0,55</td>
</tr>
<tr>
<td>1.3. Complexity in terms of number of influencing factors and interdependencies</td>
<td>4,00</td>
<td>1,07</td>
</tr>
<tr>
<td>2. Uncertainty about the basis of estimates</td>
<td>3,06</td>
<td>1,00</td>
</tr>
<tr>
<td>2.4. What resources and experience are based on</td>
<td>3,43</td>
<td>0,79</td>
</tr>
<tr>
<td>2.5. How they take into account “known unknowns”, “unknown unknowns”, “bias”</td>
<td>3,43</td>
<td>1,13</td>
</tr>
<tr>
<td>3. Uncertainty about design and logistics</td>
<td>2,78</td>
<td>0,44</td>
</tr>
<tr>
<td>3.2. Uncertainty about process of delivery</td>
<td>3,00</td>
<td>1,12</td>
</tr>
<tr>
<td>4. Uncertainty about objectives and priorities</td>
<td>2,04</td>
<td>0,70</td>
</tr>
<tr>
<td>4.3. Trade-offs/compromises</td>
<td>2,56</td>
<td>1,42</td>
</tr>
<tr>
<td>5. Uncertainty about fundamental relationships between project parties</td>
<td>2,91</td>
<td>0,86</td>
</tr>
<tr>
<td>5.4. Capability of the parties</td>
<td>3,56</td>
<td>0,88</td>
</tr>
</tbody>
</table>
RM practice

Standard methodology is used for RM?

- Yes: 44%
- NO: 56%

What was the focus of RM attention?

- Uncertainty management: 33%
- Opportunity and RM: 33%
- Risk management: 22%
- Other: 11%

Tools and techniques used in RM?

- State-of-the-art techniques: 11%
- Qualitative analysis with some quantification: 56%
- Basic qualitative analysis: 33%
RM in feasibility studies

+ 56% - financial risk analysis

+ 60% of them performed socioeconomic risk assessment

<table>
<thead>
<tr>
<th>If yes, which methodology</th>
<th>MP [#]</th>
<th>Frequency [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity Analysis</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td>Scenario Analysis</td>
<td>3</td>
<td>60%</td>
</tr>
<tr>
<td>Multi-criteria Analysis</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Cost-Benefit Analysis</td>
<td>1</td>
<td>20%</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>100%</td>
</tr>
</tbody>
</table>
## EU risks

<table>
<thead>
<tr>
<th>Risk category</th>
<th>Water supply and sanitation</th>
<th>Waste management</th>
<th>Energy</th>
<th>Roads, Railways, Public Transport, Airports, Seaports, Intermodal</th>
<th>RDI</th>
<th>Broadband</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Design risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Land acquisition risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Administrative and procurement risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Construction risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Operational risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Financial risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Regulatory risks</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Other</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Operational and financial risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Context and regulatory risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
Taking into account that whole risk mechanism this categorisation could lead to inconsistent risk analysis.

Project cost overruns and delays in construction (construction risk), is consequence of inadequate surveys and investigation (design risks) or procedural delays (administrative risk).

Therefore it is important to distinguish sources and drivers from consequence and impact when creating risk register breakdown system.
Future?

+ Collecting more case studies to achieve a global database and to obtain statistic validation.
+ Collecting more case studies to develop analysis taking into account the control variables.
+ An in-deep analysis regarding to megaproject qualitative data.
Research vs Practice from Edinbourhg

+ PRACTICE
  – risk governance – risk registers, process
  – project governance
  – integrating cost, value and risk
  – risk culture
  – contract and tendering
  – strategic management
  – how to facilitate collaborative risk management
  – transparent communication about risks – “hidden” risks
  – early risk planning identified variant options to reduce client risk