Risk Based Thinking and the Process of Risk Assessment

(Consolidated for Posting)

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The presentation deck was tailored for posting as discussed during our meeting May 10, 2016. In some cases content from several slides were consolidated into one. In other cases, pictures were removed and/or content “normalized” for posting.

*Caution: Material taken out of context is subject to misinterpretation. Published standards take precedence.*

Please contact the author with questions, comments, requests for elaboration and/or presentation to other groups.

– Keith Hornbacher, Keith@HornbacherAssociates.com (17 May 2016)
Purpose:
Raise Awareness + Increase Knowledge

■ Getting acquainted (~5 min)

■ Context (~15 min with Q&A)
  – Brief walk through the standards as we go
  – Risk, Uncertainty, and the Unexpected
  – Risk-based thinking: what is it?

■ Process of risk assessment (~25 min with Q&A)
  – Identification, Analysis, Evaluation
  – Survey results (added after input data processed)

■ Risk attitudes, heuristics and biases, cultures (~15 min with Q&A)

■ Messages to take away
Please respond with a show of hands . . .

- Managing one or more projects now?
- Are a risk manager/analyst by training and experience?
- Have read ISO 31000:2009, Risk management – Principles and guidelines?
- Private sector?
- Public sector?
- Capital expansion projects?
- Software development?
- Healthcare, medical devices?
- Others?
A little about our journey . . .

- **LOG/AN, INC. (LOS ANGELES) 1985 – 1993 EXECUTIVES AND SENIOR ANALYSTS**

- **HORNBACHER ASSOCIATES (TWIN CITIES) - FROM 1993 ONGOING**
  - Founded by Keith Hornbacher and Kristin Hauser
    - Email: Keith@HornbacherAssociates.com and KHauser@HornbacherAssociates.com
    - Direct: +1.952.891.3579

- **UNIVERSITY OF PENNSYLVANIA (PHILADELPHIA) - FROM 2005 ONGOING**
  - Organizational Dynamics Graduate Studies, School of Arts and Sciences
    - Affiliated Faculty, Email: keithh@sas.upenn.edu
  - Graduate Seminars*, Fall 2016
    - Dynm 605 Managing Operational/Project Risk, Uncertainty, and the Unexpected
      [https://www.sas.upenn.edu/lpscourses/node/4589](https://www.sas.upenn.edu/lpscourses/node/4589)
    - Dynm 683 Quantitative Project Risk Analysis Methods and Tools
      [https://www.sas.upenn.edu/lpscourses/node/4601](https://www.sas.upenn.edu/lpscourses/node/4601)

*Note: some slides are from these courses*
Some case examples from experience . . .

- Hibernia Platform in “Iceberg Alley”
- Oil Sands project in northern Alberta
- NASA missions
- GAO assignments
- FAA Wide Area Augmentation System (WAAS)
What gets us in trouble is not what we don’t know. It’s what we know for sure that just ain’t so.

~ Mark Twain
Increasing awareness and knowledge

AWARENESS
- (absent) + (present)

KNOWLEDGE
- (absent) + (present)

**Known Unknowns**

**Unknown Knowns**

**Unknown Unknowns**

**Unknown Knowns**

What makes events “unexpected”? When are they “unknowable”?
CONTEXT
We will take a brief walk-about in the standards as we discuss them . . .

*Revisions to ISO 31000:2009 and 31010:2009 are reportedly underway.
Why was ISO 13485 revised?
All ISO standards are reviewed every five years to establish if a revision is required in order to keep it current and relevant for the marketplace. ISO 13485:2016 is designed to respond to latest quality management system practices, including changes in technology and regulatory requirements and expectations.

What are the key improvements?
The new version has a greater emphasis on risk management and risk-based decision making, as well as changes related to the increased regulatory requirements for organizations in the supply chain. [bold red italics added]

Source: http://www.iso.org/iso/iso13485, downloaded 3 May 2016
Context: organizations are systems of systems

- **Organizational Culture**
- **Process, Procedure**
- **People, Attitudes**
- **Tools, Techniques, Training**

EXTERNAL

INTERNAL
2.1 risk effect of uncertainty on objectives

Notes:

1. An effect is a deviation from the expected — positive and/or negative.

2. Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process).

3. Risk is often characterized by reference to potential events and consequences, or a combination of these.

4. Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

5. Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

[emphasis added]

Automatic and quick or conscious and reasoned

- Daniel Kahneman
  - 2002 Nobel Prize in Economic Sciences for pioneering work with Amos Tversky on decision making
  - *Thinking, Fast and Slow*
    - Fast – intuitive thought (the expert and the heuristic)
    - Slow – deliberate and effortful

*Assumptions might hurt you!*

*Copyright © 2011 by Daniel Kahneman, Farrar, Straus, and Giroux, New York.*
ISO 31000:2009 Risk Management

“Effect of uncertainty on objectives”

- Common terminology?
- Universal applicability?
- Challenges to “standards”
- How do we communicate?
- Do we hear the same words with different meanings?
Risk Management Process

- Establish Context
- Identify
- Analyze
- Evaluate
- Treat

*Adapted from Figure 1, ISO 31000:2009, page vii
Challenge: Can all risks/opportunities be identified?

- Paradox of timing – we know the least when we have the most time to influence the future results . . .
- Proactive use of “management space” early enough to have a chance to make a difference
- Management processes may use “progressive elaboration”
- Residual, secondary, and emerging risks
How do you implement *that*?
Elaborated Risk Management Cycle (Iterative)

1. Identify
   - Listed
   - Risk Register Initial
   - Risk Breakdown Structure (RBS)

2. Analyze, Evaluate
   - Prioritized
   - Qualitative
   - Trigger Criteria?
   - Quantitative
   - ATTENTION ARROW

3. Treat

4. Monitor and Review
   - Risk Register Updated
   - RBS
   - Risks Grouped

Coordination and Consultation
<table>
<thead>
<tr>
<th>Risk ID</th>
<th>Short Title</th>
<th>Status</th>
<th>Date, Source</th>
<th>Owner</th>
<th>Risk Description Meta Language</th>
<th>WBS element ID</th>
<th>RBS element ID</th>
<th>Activity, Unique Task ID</th>
<th>Dependencies</th>
<th>Type^</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sample 1</td>
<td>New</td>
<td>14-Oct</td>
<td>abc</td>
<td>[Example Risk1: threat evaluated using scale]</td>
<td>1.1.1</td>
<td>1.1.5</td>
<td></td>
<td></td>
<td>T</td>
</tr>
<tr>
<td>2</td>
<td>Sample 2</td>
<td>New</td>
<td>14-Oct</td>
<td>def</td>
<td>[Example Risk2: opportunity evaluated using scale]</td>
<td>1.2.1</td>
<td>2.1.5</td>
<td></td>
<td></td>
<td>O</td>
</tr>
</tbody>
</table>

Source: DYNAM 605 Project/operational Risk, Uncertainty, and the Unexpected © 2016 Keith Hornbacher – All rights reserved
Unless each risk can be described like this . . .

Risk Description Meta Language
[As result of <definite/specific cause>, <uncertain event> may occur, which would lead to <effect on objective(s)>.]

. . . you may not have identified the root cause!!
Risk Breakdown Structure (RBS) Framework for organizing “risk drivers”

- The RBS appears similar to an organizational chart
- Hierarchy of risk sources or drivers
- This tool provides an effective reference structure for all team members to avoid omission
- An organizational RBS will evolve with succeeding projects
- Specific to types of operations, projects and/or industries
- Excellent for communication and consultation
Number of nodes varies by project size, scope
Add ID codes to identify nodes
  ✓ Map risk items into the risk register
  ✓ Track analyses, response plans, reports, and lessons learned
Identify “hot” and “cool” spots
Qualitative analysis needs definitions for levels and scores
Difficulties with descriptive probability labels

Purpose of this exercise

- Increase awareness of your common terms and phrases to describe probability
- Recognize the importance of defining terms to describe likelihood (probability) and impact
### Write in your estimates of likelihoods (handout)

<table>
<thead>
<tr>
<th>Term</th>
<th>Min %</th>
<th>Max %</th>
</tr>
</thead>
<tbody>
<tr>
<td>A good chance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Almost certain</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better than even</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definite</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly probable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly unlikely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impossible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improbable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quite likely</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rare</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seldom</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlikely</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONTEXT:**
Most of us have difficulty associating likelihoods (or probabilities) with words. This exercise illustrates the point. Jot down the first percentages that come to mind . . . They don't improve with "re-thinking".
Survey results: 10 May 2016, n = 39*

<table>
<thead>
<tr>
<th>Term</th>
<th>Mean Min</th>
<th>All Data Mean</th>
<th>Mean Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite</td>
<td>89%</td>
<td>94%</td>
<td>98%</td>
</tr>
<tr>
<td>Almost certain</td>
<td>80%</td>
<td>88%</td>
<td>95%</td>
</tr>
<tr>
<td>Highly probable</td>
<td>78%</td>
<td>85%</td>
<td>93%</td>
</tr>
<tr>
<td>Quite likely</td>
<td>67%</td>
<td>75%</td>
<td>84%</td>
</tr>
<tr>
<td>A good chance</td>
<td>62%</td>
<td>69%</td>
<td>76%</td>
</tr>
<tr>
<td>Likely</td>
<td>57%</td>
<td>68%</td>
<td>79%</td>
</tr>
<tr>
<td>Probable</td>
<td>54%</td>
<td>66%</td>
<td>78%</td>
</tr>
<tr>
<td>Better than even</td>
<td>50%</td>
<td>59%</td>
<td>68%</td>
</tr>
<tr>
<td>Possible</td>
<td>35%</td>
<td>53%</td>
<td>72%</td>
</tr>
<tr>
<td>Unlikely</td>
<td>9%</td>
<td>18%</td>
<td>27%</td>
</tr>
<tr>
<td>Highly unlikely</td>
<td>9%</td>
<td>17%</td>
<td>25%</td>
</tr>
<tr>
<td>Seldom</td>
<td>9%</td>
<td>17%</td>
<td>24%</td>
</tr>
<tr>
<td>Improbable</td>
<td>10%</td>
<td>14%</td>
<td>19%</td>
</tr>
<tr>
<td>Rare</td>
<td>7%</td>
<td>14%</td>
<td>22%</td>
</tr>
<tr>
<td>Impossible</td>
<td>5%</td>
<td>9%</td>
<td>13%</td>
</tr>
</tbody>
</table>

- **Interesting responses (n):**
  - **Definite**
    - Min = 100% (14); Max=100% (34)
  - **Impossible**
    - Min = 0% (30); Max=0% (2)

Two terms, definite and impossible, were included as checks (intended to be 100%, 0%, respectively). MN-ASQ persons who responded to this survey scored better than many other groups polled using the same list.

*39 complete responses (5 partial responses not included in tabulation)*

See: Describing Probability: the limitations of a natural language
– © 2005 David T. Hillson, Ph.D.
3 x 3 Probability : Impact Grid / Matrix with iso-risks

<table>
<thead>
<tr>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>H, L</td>
</tr>
<tr>
<td></td>
<td>H, M</td>
</tr>
<tr>
<td></td>
<td>H, H</td>
</tr>
<tr>
<td>Medium</td>
<td>M, L</td>
</tr>
<tr>
<td></td>
<td>M, M</td>
</tr>
<tr>
<td></td>
<td>M, H</td>
</tr>
<tr>
<td>Low</td>
<td>L, L</td>
</tr>
<tr>
<td></td>
<td>L, M</td>
</tr>
<tr>
<td></td>
<td>L, H</td>
</tr>
</tbody>
</table>

- **Treat Risks**: Usually treat risks when probability is High and impact is also High.
- **Watch Risks**: Watch risks when probability is Medium and impact is Medium.

Conventional Qualitative P x I Approach (terms and thresholds need to be defined)
Simple P x I Matrix (linear impact scale)

**Example:**

- **P** = 4,
- **I** = 3,
- **Level** = 12

**Thresholds:**

- **HI** > 12,
- **LO** < 8
Impact-averse scale shifts levels of importance
Red Increases, Yellow Decreases

<table>
<thead>
<tr>
<th>PROBABILITY</th>
<th>VHI</th>
<th>HI</th>
<th>MED</th>
<th>LO</th>
<th>VLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHI</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>HI</td>
<td>5</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MED</td>
<td>5</td>
<td>10</td>
<td>12</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>LO</td>
<td>5</td>
<td>20</td>
<td>24</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>VLO</td>
<td>5</td>
<td>40</td>
<td>48</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example:
P = 4, I = 4, Level = 16

Thresholds Still
HI > 12, LO < 8
Achieve balance by illustrating both threats and opportunities – known as the “butterfly”

<table>
<thead>
<tr>
<th>Prob.</th>
<th>Threats</th>
<th>Opportunities</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHI</td>
<td><img src="image" alt="VHI Threats" /></td>
<td><img src="image" alt="VHI Opportunities" /></td>
<td>VHI</td>
</tr>
<tr>
<td>HI</td>
<td><img src="image" alt="HI Threats" /></td>
<td><img src="image" alt="HI Opportunities" /></td>
<td>HI</td>
</tr>
<tr>
<td>MED</td>
<td><img src="image" alt="MED Threats" /></td>
<td><img src="image" alt="MED Opportunities" /></td>
<td>MED</td>
</tr>
<tr>
<td>LO</td>
<td><img src="image" alt="LO Threats" /></td>
<td><img src="image" alt="LO Opportunities" /></td>
<td>LO</td>
</tr>
<tr>
<td>VLO</td>
<td><img src="image" alt="VLO Threats" /></td>
<td><img src="image" alt="VLO Opportunities" /></td>
<td>VLO</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Impact" /></td>
<td><img src="image" alt="Impact" /></td>
<td></td>
</tr>
</tbody>
</table>

*Note: Hillson labeled this region the “Attention Arrow” in Effective Opportunity Management for Projects, CRC Press, 2004.*
All organizations should aim at the appropriate level of performance of their risk management framework in line with the criticality of the decisions that are to be made.

Key Outcomes

- Organization has current, correct and comprehensive understanding of its risks
- Organization's risks are within its risk criteria

Attributes

- Continual improvement
- Full accountability for risks
- Application of risk management in all decision making
- Continual communication
- Full integration in organization’s governance structure

*Informative Guidance, adapted from Annex A pages 22-23
<table>
<thead>
<tr>
<th>Observable Characteristics</th>
<th>Levels of Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Definition</td>
<td>1. Ad Hoc</td>
</tr>
<tr>
<td>II. Culture</td>
<td>2. Initial</td>
</tr>
<tr>
<td>III. Process</td>
<td>3. Repeatable</td>
</tr>
<tr>
<td>IV. Experience</td>
<td>4. Managed</td>
</tr>
<tr>
<td>V. Application</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Collaboration Group (INCOSE, PMI, APM) – copies available on request*
Recall the Risk Management Process

[Diagram of Risk Management Process]

*Adapted from Figure 1, ISO 31000:2009, page vii
Risk Management Cycle
Implements Risk-Based Thinking in Decisions

1. Identify Risks
   - Root Causes

2. Risk Register Initial
   - Risk Breakdown Structure (RBS)

3. Analyze, Evaluate
   - Assessments

4. Prioritized Treatments
   - Action Plans

5. Monitor and Review
   - Treated

Risk Register Baseline

Establish/Maintain Context, Communicate and Consult
Implement Risk Management Throughout Project Life Cycle

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Truth is ever to be found in simplicity, and not in the multiplicity and confusion of things.

Isaac Newton
Information not discussed during presentation but worth considering

Quantitative Risk Analysis using Simulation

Please contact authors for information
How important are leaders of organizations?
Some look good and say the right things!
our vision

Enron's vision is to become the world's leading energy company — creating innovative and efficient energy solutions for growing economies and a better environment worldwide.

our values

respect
We treat others as we would like to be treated ourselves. We do not tolerate abusive or disrespectful treatment. Ruthlessness, callousness, and arrogance don't belong here.

integrity
We work with customers and prospects openly, honestly, and sincerely. When we say we will do something, we will do it; when we say we cannot or will not do something, then we won't do it.

communication
We have an obligation to communicate. Here, we take the time to talk with one another... and to listen. We believe that information is meant to move and that information moves people.

excellence
We are satisfied with nothing less than the very best in everything we do. We will continue to raise the bar for everyone. The great fun here will be for all of us to discover just how good we can really be.
But are not trust worthy!
On the other hand . . .
Good leaders seek the opportunity to learn

... I’m grateful for the advice my parents always gave me about working hard, admitting what you don’t know and not being afraid to ask for help. Assume the good in people and be prepared to learn from everyone. More often than not, your colleagues and team will help you succeed!

- Mary Barra CEO, General Motors Company

Downloaded May 3, 2016
Messages to take home

- Risk Management using best practices proven to work
- *Risk-Based Thinking* likely to increase organizational resilience and success
- Risk attitudes and cultures influence organizational behavior
- People resources can be trained in methods and tools
- Effective leaders listen and learn (PDCA)
- We only scratched the surface here . . . !
A visualization to help remember context

Downey or Hairy Woodpecker?
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(Consolidated for Posting)

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