INCORPORATING RISK INTO OPTIMIZED STRATEGIC INVESTMENT DECISIONS

Mackinac Bridge, Michigan, USA

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Agenda

• Risk – Initial Thoughts

• Strategic Decisions

• How To Allocate Funding With Risk

• Thoughts To Take Away
Everyone is talking about it, rarely put it into practice

• Risk means different things to people.
• Risk is employed at an operational, tactical and strategic level
• The equation is familiar $C \times L = \text{Risk}$, the challenge lies in the detail
• Makes for very few good practice examples, despite the interest.
Risk Perception Factors

We over-estimate with
• Dread
• Natural risks
• Children
• Novelty
• It directly affecting me
• When we don’t trust the messenger

We under-estimate when
• We have some control
• It is human-made risk
• We have choices
• There is a risk benefit trade-off
• When we trust the messenger
The Problem

How to allocate funds across multiple service areas and infrastructure portfolios?
Risk Has Utility at Multiple Levels

Strategic
- e.g. – Funding Allocation, performance monitoring

Tactical
- e.g. - Criticality, Project Risk

Operational
- e.g. Procurement, Safety, Contract Risk

Vertical Integration

- Community Outcomes
- Asset Outcomes
- Service Levels
- Intervention Levels
- Work Instructions
- Physical Work

E.g. – Criticality, Project Risk
E.g. Procurement, Safety, Contract Risk
E.g. – Funding Allocation, performance monitoring
STRATEGIC DECISIONS

Panmure Station, Auckland, New Zealand
Investment Decisions for Infrastructure

- Alignment with goals and objectives of the agency
- Funding allocation in each bucket can be challenging
- Elected officials and decision-makers often don’t respond to the technical language well enough to get the allocation right
Example: Triple Bottom Line

- Multi-Criteria Analysis to assess investment alternatives
- Assess infrastructure investments alignment to agency goals
- Transparent, objective, and allows for an assessment of different asset types
- Weightings and criteria can change as the priorities of government change.

<table>
<thead>
<tr>
<th>QBL</th>
<th>Provincial Objectives</th>
<th>Criteria</th>
<th>Indicator Weight</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic (Wt = 60)</td>
<td>Stronger Economy (Wt = 26)</td>
<td>Job Creation</td>
<td>7</td>
<td>Jobs created after construction</td>
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<tr>
<td></td>
<td></td>
<td>Foster Private Sector Business Growth</td>
<td>8</td>
<td>Impact on transportation costs to input and output markets (i.e., labour, supplier, and customer markets)</td>
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<td></td>
<td>Supports Economic Development Plans</td>
<td>Level of support for initiatives in provincial economic development plans</td>
<td>8</td>
<td></td>
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<tr>
<td></td>
<td>Living Within Our Means (Wt = 24)</td>
<td>Effective Service Delivery</td>
<td>8</td>
<td>Infrastructure provides the required capacity to meet present and future needs at acceptable levels of service</td>
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<tr>
<td></td>
<td></td>
<td>Maximizes Leveraging Opportunities</td>
<td>8</td>
<td>Impact on network operating, maintenance, and rehabilitation costs</td>
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<tr>
<td></td>
<td>Environment (Wt = 18)</td>
<td>Mitigate risks of climate change</td>
<td>8</td>
<td>Potential for sharing infrastructure costs with a public or private sector partner</td>
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<tr>
<td></td>
<td></td>
<td>Environmental Impacts</td>
<td>5</td>
<td>Impact on GHG emissions</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>Other environmental impacts</td>
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<tr>
<td></td>
<td>Social (Wt = 22)</td>
<td>Health and Safety Impacts</td>
<td>10</td>
<td>Impact on risk of a casualty collision (i.e., injury or fatal collision)</td>
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<tr>
<td></td>
<td></td>
<td>Access to services that meet primary needs</td>
<td>5</td>
<td>Impact on access to emergency services</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Supported by community plans</td>
<td>3</td>
<td>Level of local community support</td>
</tr>
<tr>
<td></td>
<td>Cultural (Wt = 10)</td>
<td>First Nations</td>
<td>5</td>
<td>Impact on First Nations lands, culture, or community</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Preserves or Enhances Heritage Resources</td>
<td>5</td>
<td>Impact on heritage resources</td>
</tr>
</tbody>
</table>

* Preliminary weights developed by DTI Project Team. Weights should be reviewed periodically.
Renewal Decision-Making

- Agencies use a variety of analytics for renewal decisions
- Typically a variety of investment / treatment types are considered
- Objectives can be varied to assess the impacts of different investment alternatives
  - Hold Budget, Hold Condition
  - Target State / Service Level

Some clients starting to use risk as the primary objective function for strategic, long term funding allocation
HOW TO ALLOCATE FUNDING WITH RISK

Sea to Sky Highway, Canada
Achieving Service Levels

• Roads exist to provide a service:
  • Mobility and Land Access

• Service levels are customer focussed
  • Travel time / delay
  • Safety
  • Reliability
  • Availability
  • Rideability / Comfort

• Technical proxies have predominated
  • IRI, SDI, BCI, Rut Depth
Evolution of the Methodology

- Consequence is quantified as asset importance to agency goals, i.e. service level delivery failure’s effect of achieving mandate
- TBL used to assess of importance of that asset and represent risk consequence / Performance Importance / a form of criticality linked to the degree of alignment to agency goals and objectives
- Condition used as a proxy for likelihood of failure, especially when actual probability is unknown
- In this way, a target risk level can be the objective function for investment analytics
Municipal Application

• Multiple services to deliver and asset portfolios
• Funding allocation between service/asset groups
• Mechanism hinges on risk levels being traded-off against investment
Mechanism

- Model allocates funds incrementally to maximize risk reduction benefit
- Not necessarily the most risky
- Allocation to reduce risk as much as possible within constrained budgets, over time
Benefits

• Politicians and decision makers respond to risk more readily, and actually are more worried about getting it wrong
• Provides common language to communicate and evaluate financial investment choices across very different assets / services
• “Consequence” / goal alignment is the most difficult aspect to consistently apply.
• Triple Bottom Line is the best way to evaluate portfolio assets relative importance
How well does your organisation define its goals and objectives?

**Strategy Map | 2012 – 2013**
Providing quality services to support a prosperous, fair and just society for New Brunswick.

**Vision 2015**
- **Citizens**
  - Foster private sector business growth
  - “Stimulate creation of quality jobs”
  - “More people working”
  - “Provide value for my tax dollars”

- **Financial**
  - Meet or under spend expense budget
  - Meet or exceed revenue budget commitments

- **Internal Processes**
  - Focus and streamline economic development efforts
  - Improve workforce readiness
  - Ensure access to services that meet primary needs

- **Enablers**
  - **People Readiness**
    - Develop process improvement competencies
    - Attract, develop and retain leadership talent
  - **Information Readiness**
    - Deliver relevant, timely and quality information
  - **Performance Excellence Culture**
    - Align department performance to GNB Strategy

A few stones need to be laid before you can model risk in this way

Cross Asset, Risk Based Funding Allocation

Optimized Decision Making

- Objectives
- Costs
- Treatments
- Inventory
- LOS
- Constraints
- Maintenance
- Demand
- Condition
- Governance
Thoughts to take away

• Risk can help allocate funds
• Method requires a good definition of agency goals and objectives that are translated to an objective MCA framework
• Optimized funding is important when funding is limited.
• Complex problems require powerful tools, ODM is a one you may have in your toolkit
• Build your foundation
QUESTIONS?

Mackinac Bridge, Michigan, USA
Balancing Delivery

Budget

$100

Inventory

Level of Service Performance

0

10
deterioration

Consequence of Failure

Risk

$0

10

Services
Risk Example

Roads Risk Profile

- Max Tolerable Risk: 1368
- Current Risk: 681
- Target Risk: 684
- Absolute Risk: 3405

Watermains Risk Profile

- Max Tolerable Risk: 13167
- Current Risk: 9852.5
- Target Risk: 6384
- Absolute Risk: 19950