Informed Funding Decisions:
A Proposal for a New Costing Paradigm
27th International Colloquium on Financial Management
for National Governments
September 2015

Roger Ermuth
Assistant Comptroller General, Financial Management Sector
The Costing Centre of Expertise (CCE) was created in 2014 to address Ministerial concerns with respect to insufficient cost estimating information to support decision-making.

The CCE has a dual mandate:
- Ensure departmental costing capacity to generate robust cost estimates through:
  - Training and development
  - Strengthening of policies and guidance documents
- Strengthen the costing challenge function for Cabinet submissions
  - Independently validate cost estimates of higher risk submissions
  - “Deep dives” of sensitive submissions or initiatives
  - Develop comparative information and metrics for reasonableness assessments
Costing by its Very Nature is Uncertain

• Doing something for the first time; making it hard to explain requirements to industry, which may not have the skills to do the work

• New activities do not have a strong foundation of historical information on which to base cost estimates

• People sell ideas which usually are not precise because they are still being developed

• Funding considerations may squeeze cost estimates to the point that the full scope of the project can not be delivered as planned

• Changes to the proposal throughout the approval process may prevent decision-makers from receiving the right information at the right time
One Year Out: Current Challenges

- **Uneven Capacity**: Departments have an uneven ability to develop robust cost estimates.

- **Informed Decision-Making**: A lack of contextual costing information at the time when decisions are made hinders decision-makers’ ability to fully understand the financial risks associated with a project:
  - There is a lack of comparative information and metrics to challenge cost estimates.
  - Costing, by its very nature, is based on estimates. Decision-makers are given a point estimate despite the fact that estimates will change based on a number of factors including: scope, framing assumptions, options analyzed, fluctuations in key inputs and schedule changes.
Uneven Capacity: Needs Vary

• Not all organizations require the same capacity - SMART investment
  - CCE using a Cost Estimating Maturity Study to determine capacity requirements and potential gaps (Annex A provides details)

• Specific skill-sets are required for different types of cost estimating
  - Professional qualification for complex cost estimates
  - Professional associations (i.e. CPA Canada) for advanced estimates
  - Canada School of Public Service for basic estimates

• Restructured guidance on cost estimating (web portal approach)
  - Directives that expand upon core concepts
  - Bulletins that are flexible and clarify specific elements (e.g. treatment of foreign exchange)
  - CFO Attestation recalibration underway to incorporate lessons learned after one year of implementation
Informed Decision-Making: Comparative Information

• Developing comparative information is underway to build metrics and standard costs for reasonableness testing
  - Ongoing challenge with many false starts
  - Linkage to broader performance measurement strategy
  - Need to move forward requires use of imperfect information that is directionally correct but precisely inaccurate

• Lessons learned in the process
  - Publicly available data is better than many think
  - Keep it simple and you need to build as you go
  - Start moving!

• Initial findings
  - Departments cluster primarily on the basis of size and complexity
  - Internal Service costs are primarily some form of labour
Informed Decision-Making: The Fallacy of Cost Certainty

• Point estimates are used to communicate cost estimates; the only thing we know for certain is that the number presented is wrong.

• What do decision-makers want?
  – Decisions are primarily made on the basis of perceived certainty because people do not like uncertainty.
  – When making decisions, people rely on personal experience to resolve uncertainty in their minds. This approach may not be appropriate in all circumstances.

• Need to shift the paradigm to provide contextual information to decision-makers
  – need to understand sensitivity to framing assumptions and key inputs
  – need to understand interplay of risks between different inputs

• What we have typically provided decision-makers
  - Decision-makers are typically only provided with a point estimate that fits our perceived understanding of affordability
  - Sensitivity analysis may be provided to support the risk assessment

• Sensitivity analysis is usually from a Project Manager’s perspective
  - Scope
  - Schedule
  - Costs
  “What ifs” to determine cost sensitivity to key factors

• Statistical models help us understand the financial risks of a project
  - There is always uncertainty in a cost estimate; it reduces over time
  - Costs cluster, but outliers can distort average costs
  - Risks cannot be fully captured in a point estimate
Informed Decision-Making: Statistical Modeling – A potential solution

- Decision points have different levels of inherent risk. The cost estimate range of an idea (A) will be broader than the cost estimate range of a fully analyzed option proposed for implementation (C).
- Statistical models can be used to identify likely cost outcomes and the key inputs with the greatest impact on the potential cost of the proposal.
- The decision points are:
  - A – Budget Proposal
  - B – Memorandum to Cabinet (policy)
  - C – Treasury Board Submission (funding)
  - D – Project Close Out
Desired Outcomes: From What to Why?

• With statistical modelling, decision-makers are provided with information to assess:
  – Impact of changes in price or volumes on cost estimates
  – Potential impact of schedule delays on cost estimates
  – Sensitivity of the cost estimate to risk (key input changes)

• Increased understanding of risk sensitivity will allow project managers to strengthen cost estimates between decision points:
  – Targeted work to refine cost estimates – reduce time and options analysis costs while increasing confidence in information presented
  – Risk mitigation strategies identified for the specific inputs of most significance to the overall cost estimate

• Target follow-up reporting, reduce reporting burden on project teams
Conclusion and Next Steps

• Office of the Comptroller General has made significant progress, but much remains to be done
  – Importance of departmental capacity commensurate with the complexity of their proposals cannot be overstated
  – Departmental engagement in developing standard costs is essential to ensure cost clustering conclusions are valid
  – Contextual information, including a sophisticated presentation of financial risk, is key to better informed decision-making

• However, this approach requires a paradigm shift in terms of how decisions are made:
  – Telling the ‘story’ of a project’s costs requires more context
  – For complex proposals the funding approach may need to change
  – Significant training and change management are required
Core Requirements for Cost Estimating

• While capacity needs vary, the core requirements for cost estimating are consistent:
  – Evidence: data and evidence standards
    • Verifiable evidence with clearly identified assumptions exists
  – Tools: appropriate industry standard approaches
    • Tools appropriate to the cost estimating challenge are appropriately applied
  – Skill-sets: appropriately skilled analysts build the cost estimate
    • People with skill-sets commensurate with the complexity of the proposal are engaged in developing the cost estimate
  – Process(es): steps used to develop the cost estimate
    • Consistent processes are used across the entity of government, recognizing differences in application
Illustrative Example

• An organization proposes to acquire a COTS IT solution with a total cost of $530,450 including a contingency of $15,450
  - Initial acquisition price: $100K
  - Licenses: $0.5K/user (170 users)
  - Implementation Costs
    • Configuration: $1K/day (50 days)
    • Salaries: 3 staff for $250K
    • Training development: $20K
    • Training delivery: $1K/day (10 sessions)
  - Overhead can be absorbed within existing levels
Illustrative Example: A Typical Point Estimate

Based on a Project Manager's Cost Estimate

**Acquisition Costs**

Software $100,000
Licences 170 licences $500 each $85,000
**Total Acquisition Costs** $185,000

**Implementation Costs**

Staff 3 staff $250,000
Professional Services 50 days $1000 day $50,000
Training Development 20 days $1000 day $20,000
Training Delivery 10 days $1000 day $10,000
**Total Implementation Costs** $330,000
Contingency (3%) $15,450
**Total Project Costs** $530,450
**Illustrative Example: As a Sensitivity Analysis**

Based on a Program Manager's Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th>Most</th>
<th>Best Case</th>
<th>Likely</th>
<th>Worst Case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acquisition Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Software</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$96,000</td>
<td>$100,000</td>
<td>$120,000</td>
<td></td>
</tr>
<tr>
<td>Licences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$76,800</td>
<td>$85,000</td>
<td>$151,200</td>
<td></td>
</tr>
<tr>
<td><strong>Total Acquisition Costs</strong></td>
<td>$172,800</td>
<td>$185,000</td>
<td>$271,200</td>
<td></td>
</tr>
<tr>
<td><strong>Implementation Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$240,000</td>
<td>$250,000</td>
<td>$300,000</td>
<td></td>
</tr>
<tr>
<td>Professional Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$39,360</td>
<td>$45,000</td>
<td>$75,600</td>
<td></td>
</tr>
<tr>
<td>Training Development</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$18,800</td>
<td>$20,000</td>
<td>$26,000</td>
<td></td>
</tr>
<tr>
<td>Training Delivery - Costs</td>
<td>$7,680</td>
<td>$9,000</td>
<td>$14,400</td>
<td></td>
</tr>
<tr>
<td><strong>Total Implementation Costs</strong></td>
<td>$305,840</td>
<td>$324,000</td>
<td>$416,000</td>
<td></td>
</tr>
<tr>
<td>Contingency (3%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$14,359</td>
<td>$15,270</td>
<td>$20,616</td>
<td></td>
</tr>
<tr>
<td><strong>Total Project Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>$492,999</td>
<td>$524,270</td>
<td>$707,816</td>
<td></td>
</tr>
</tbody>
</table>

Annex B
Illustrative Example:  
As a Statistical Model

### Acquisition Costs

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Lower Data Point</th>
<th>Most Likely Data Point</th>
<th>Upper Data Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software</td>
<td>$ 96,000</td>
<td>$ 100,000</td>
<td>$ 120,000</td>
</tr>
<tr>
<td>Licences - Cost/Licence</td>
<td>$ 480</td>
<td>$ 500</td>
<td>$ 600</td>
</tr>
<tr>
<td>Licences - Number needed</td>
<td>160</td>
<td>170</td>
<td>252</td>
</tr>
<tr>
<td><strong>Total Acquisition Costs</strong></td>
<td><strong>$ 172,800</strong></td>
<td><strong>$ 185,000</strong></td>
<td><strong>$ 271,200</strong></td>
</tr>
</tbody>
</table>

### Implementation Costs

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Lower Data Point</th>
<th>Most Likely Data Point</th>
<th>Upper Data Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td>$ 240,000</td>
<td>$ 250,000</td>
<td>$ 300,000</td>
</tr>
<tr>
<td>Professional Services - Costs</td>
<td>$ 960</td>
<td>$ 1,000</td>
<td>$ 1,200</td>
</tr>
<tr>
<td>Professional Services - Days</td>
<td>41</td>
<td>45</td>
<td>63</td>
</tr>
<tr>
<td>Training Development</td>
<td>$ 18,800</td>
<td>$ 20,000</td>
<td>$ 26,000</td>
</tr>
<tr>
<td>Training Delivery - Costs</td>
<td>$ 960</td>
<td>$ 1,000</td>
<td>$ 1,200</td>
</tr>
<tr>
<td>Training Delivery - Days</td>
<td>8</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total Implementation Costs</strong></td>
<td><strong>$ 305,840</strong></td>
<td><strong>$ 324,000</strong></td>
<td><strong>$ 416,000</strong></td>
</tr>
<tr>
<td>Contingency* (0%)</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td><strong>Total Project Costs</strong>**</td>
<td><strong>$ 478,640</strong></td>
<td><strong>$ 509,000</strong></td>
<td><strong>$ 687,200</strong></td>
</tr>
</tbody>
</table>

*contingency is built into the model

**Estimates are only as good as the analysis/assumptions used for each data point**
Informed Decision-Making: Statistically Modelled Cost Estimate

- 95% estimate: $585,365
- 66% estimate: $559,630
- Certainty Max: $530,000
- Certainty: 11.81%

- Low probability of achieving the proposed cost estimate
- Project Manager’s identified cost estimate
  - Based on model, there is only a 1:3 chance the actual costs will exceed $559,630
  - Certainty Max = $530,000
  - 66% = $559,630
- Worst case scenario cost: unlikely to exceed $585,365

Very likely costs will exceed $530,000, but modeled “worst case” costs are $585,363 versus sensitivity analysis “worst case” costs of $707,816
A Comparison of the Methodologies

- Typical cost estimate (Base Case (BC)) $530,450

- Sensitivity analysis (3 what-if scenarios)
  - Best Case $492,999 93% of BC
  - Most Likely $524,270 99% of BC
  - Worst Case $707,816 134% of BC

- Statistically modeled (1M times) using random numbers within probability distributions
  - Best Case $530,450 (very unlikely) 100% of BC
  - Most Likely less than $559,630 106% of BC
  - Worst Case less than $585,365 110% of BC