DRDC | RDDC
technologysciencetechnologie

Implications of the Deloitte DPR Model

Christopher E. Penney
Binyam Solomon
Chad Young
DRDC – Centre for Operational Research and Analysis

Defence Research and Development Canada

Canada

IMPORTANT INFORMATIVE STATEMENTS

This document was reviewed for Controlled Goods by DRDC using the Schedule to the *Defence Production Act*.

Endorsement statement: This publication has been published by the Editorial Office of Defence Research and Development Canada, an agency of the Department of National Defence of Canada. Inquiries can be sent to: Publications.DRDC-RDDC@drdc-rddc.gc.ca.

Abstract

In June 2016, ADM Fin contracted Deloitte to aid in providing life cycle cost estimates for the full suite of projects included in the Defence Policy Review (DPR) and to develop a project cost compilation model to allow for high level visibility into the DPR's budgetary impacts. Importantly, this model supplanted the Strategic Cost Model (SCM) which previously acted as ADM Fin's enterprise-level costing model. This Reference Document provides an overview of the functionality of the Deloitte DPR model, compares and contrasts it with the legacy SCM, and discusses the implications of the usage of the Deloitte DPR model as an enterprise-level costing model going forward.

Résumé

En juin 2016, le SMA(Fin) a retenu les services de Deloitte pour l'aider à fournir des estimations des coûts du cycle de vie pour l'ensemble des projets inclus dans l'Examen de la politique de défense (EPD) et pour élaborer un modèle de compilation des coûts des projets afin de permettre une visibilité générale des répercussions budgétaires de l'EPD. Il est important de noter que ce modèle a remplacé le modèle stratégique de prévision des coûts (MSPC) qui servait auparavant de modèle d'établissement des coûts au niveau de l'organisation du SMA(Fin). Le présent document de référence donne un aperçu de la fonctionnalité du modèle d'EPD de Deloitte, le compare et le met en contraste avec l'ancien MSPC, et souligne les répercussions des implications de l'utilisation du modèle d'EPD de Deloitte comme modèle d'établissement des coûts à l'échelle de l'organisation dans le futur.

Table of contents

List of figures

1   Introduction

In June 2016, ADM Fin contracted Deloitte to provide life cycle cost estimates for the full suite of current and forthcoming procurement projects and to develop a project cost compilation model in support of the Defence Policy Review (DPR). This model includes an analysis tool that allows decision makers to compare budgetary impacts of adopting alternate courses of action in Investment Plan (IP) initiatives. The CFO has since indicated an interest in potentially adopting and integrating this model across all financial and business analytics currently conducted within the ADM Fin organization. In assuming these functions for the purpose of the DPR, the project cost compilation model ('DPR model' hereafter) has supplanted the final iteration of the Strategic Cost Model, which had fallen into disuse in recent years.

This Reference Document begins with a brief overview of the legacy SCM and the DPR models and provides a comparison of each model's capabilities; following this, we discuss the potentiality of the DPR model being used as an enterprise-level costing model and examine the implications with respect to CFO costing standards. Additionally, Annex A provides a detailed comparison of the DPR and SCM models as concerns their suitability with respect to CFO requirements.

2   The Legacy Strategic Cost Model

The first iteration of the SCM was developed in 2005 in order to respond to an ongoing need for total defence budget visibility in strategic decision making. The model is based on a cost relationship network wherein cost "objects" are linked via either a *supporting* or *supported* relationship, which are then characterized by cost attribution rules. These rules allow for the rolling-up of costs into higher level cost objects. The SCM network consists of hundreds of objects with various attribution rules and expenditure categories.

3   DPR Model Overview

Total costs in the DPR model are broken down into two major categories: first, the underlying 'baseline' costs are assumed invariant and include personnel costs and maintenance for pre-existing assets; the second is the much larger 'projects' element, wherein the hundreds of individual projects in the investment plan are calculated and brought into the model.

Figure 1 presents a simplified overview of the functionality of the DPR model. The model is built in the Alteryx Developer Software Suite and uses Excel spreadsheets as inputs. It consists of three main components: the Consolidation Tool, which compiles all costed projects and baseline costs and applies inflation, contingency and exchange rate assumptions from the Master Data Assumptions List (MDAL); the Options Tool, which allows CFO staff to construct separate Courses of Action (COA) for comparison purposes; and the Visualization Tool, powered by Tableau, which uses the model's output to generate graphs.
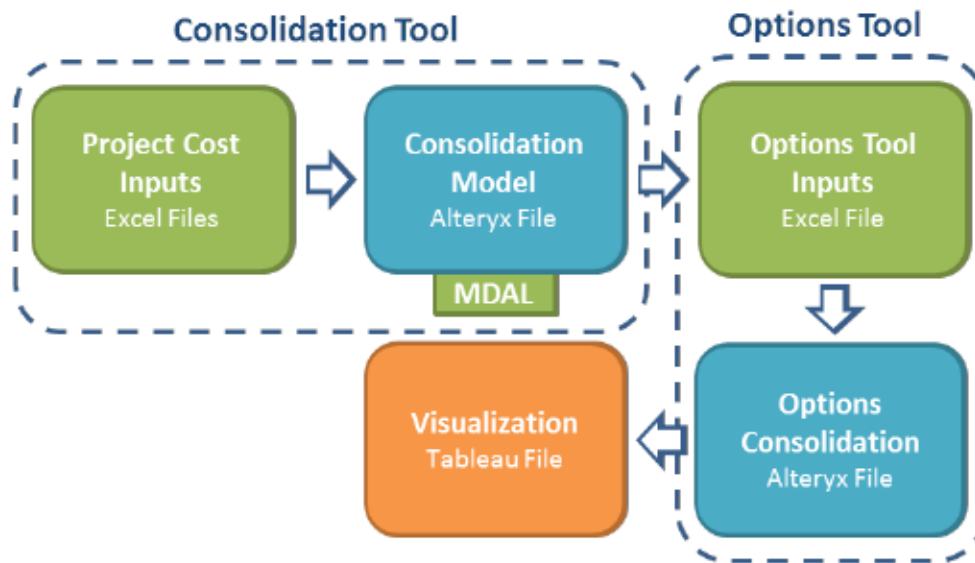
Figure 1: Deloitte DPR Model Overview.

The model uses the latest input and baseline data from CFO databases such as the Defence Personnel and Operations and Maintenance Model (DPM), the Investment Plan, and projects identified in the Capital Investment Program Plan Review (CIPPR). This baseline data, along with the new and updated project-level life cycle costings performed by Deloitte, is then normalized using inflation and exchange rate forecasts provided by the CFO organization. The model also maps costs according to the Cost Breakdown Structure (CBS) and uses the cost attribution rules and indirect cost attribution algorithms from the SCM to provide a full-cost view of capabilities. For projects and capabilities developed after the last update of the SCM, Force Development personnel from the Vice Chief's office are consulted to develop an appropriate mapping.

3.1 Comparison to SCM

The Deloitte model offers some advantages over its predecessor. CFO staff can input new "projects" via a costing template in Excel for relatively rapid inclusion into the budget. The Options Tool is especially useful in supporting DPR requirements as decision makers compare alternate options for upcoming and ongoing procurement activities, such as a change in the number of fighter aircraft to be procured, or a delay in the start of a procurement initiative. This level of granularity allows for a basic level of comparison and differentiation between fixed and variable costs.

The mapping of costs according to the CBS and military capabilities represents an improvement over the SCM's sole use of cost attribution rules: in the DPR model, projects are mapped directly to the functions and services that they deliver.

The model is capable of producing estimates in a relatively short amount of time. Entering a new project into the Consolidation Tool and running the entire model can be accomplished within a day; changing assumptions and courses of action in the Options Tool and assessing the final impact of these changes in the visualization module can be done within a few hours. In the previous SCM, updating the model to produce new estimates was a highly laborious process, and it was not designed for use as a comparison tool.

The model is subject to some of the same deficiencies present in the SCM. In particular, the Consolidation Tool and project input templates are very sensitive to even minor errors in data entry. The template format is arbitrary in nature and requires precise manipulations in order for the Consolidation Tool to accept the input. The model therefore requires close attention and quality assurance checks when producing budget estimates.

As Deloitte was initially contracted solely for the support of the DPR, the possibility of maintaining and updating the model for future use was not taken into account. As such, the model as it exists contains only a snapshot of current and planned procurement projects. Maintaining the model for ongoing use would require the manual modification of a large amount of individual projects, baseline data, and underlying assumptions on a continuing basis.

A comparative description of the SCM and DPR models from the perspective of CFO requirements is given in Annex A.

4 The DPR Model as an Enterprise-Level Costing Model

In 2015, DRDC CORA advised the CFO organization that an enterprise level costing model is a persistent but unfulfilled requirement in DND [1]. The DPR model is not only a more recent manifestation of this fact but also represents a critical element for the way forward. The model now contains the most up to-date costing data, definitions and business processes. In order to make the model an enterprise-level costing tool, however, some modifications are required. An enterprise-level costing tool should enable:

1. Links to Departmental performance reporting and insight as to how financial data ought to be mapped to outcomes and outputs;

2. Optimization and cost-benefit analysis. Specifically, there are no optimization tools for defence outcomes and there is no consideration for conducting marginal analysis;[1]

---

[1] This role had been filled by the Visual Investment Plan Optimization and Revision (VIPOR) model; in practice, this would supplement or replace the visualization tool present in the DPR model.

3. Further integration with corporate information systems such as real property, etc.; and

4. Possible development of activity-based costing.

5 Considerations for the Way Forward

With the conclusion of the first iteration of the DPR, the Deloitte DPR model remains a potential candidate for the analysis of future policy adjustments and even full-scale revisions. DRDC CORA's role in this phase is relevant to provide a challenge function on not only the methodology of the model itself but also the ground rules and assumptions that surround project costs and the associated cost risk factors. In aiming to support the CFO organization on this long-term requirement, future DRDC CORA analyses should address the following:

1. Ensure that proper cost risk analyses are conducted for all projects. At present, the DPR model attributes risk based on a simple coding of risk likelihoods with associated cost contingencies varying between 0% and 100%; this does not follow the guidelines set in the Cost Risk Framework [2]. It is therefore necessary to replace the contingency amounts with numbers derived from the analysis with proper bounds and replace the current contingency-based risk;

2. Seamlessly integrate the in-service support and sustainment cost estimates and methodologies, including both the NP and platform-specific sustainment forecasts of Directorate Materiel Group Operations Reseach (DMGOR) and the empirical tools developed and being developed by the Defence Economics Team (DET);

3. Assess the mapping between projects and capabilities in the Deloitte model, including the verification of the indirect cost attributions for capabilities and projects; and

4. Provide framework and business processes to integrate the DPM; this includes updates of the Cost Factor Manual (CFM) and other strategic financial reports such as Expenditure by Electoral Districts, notional databases, slippage forecasts and supply and funding models.

References

[1] Young, C. and Yazbeck, T. (2015), Impetus and rationale for a CND/CAF Strategic Cost Model, *Scientific Letter, Defence Research and Development Canada,* Vol. 2015-L444.

[2] Ghanmi, A., Rempel, M., Sokri, A., and Solomon, B. (2014), Cost Risk Framework, *Scientific Report, Defence Research and Development Canada*, Vol. 2014-R167.

[3] Desmier, P. E. (2016), Forecasting National Procurement Costs for the Light Armoured Vehicle (LAV) 6.0 Fleet, *Scientific Report, Defence Research and Development Canada*, Vol. DRDC-RDDC-2016-R178.

Annex A Comparison Matrix

Table A.1: Comparison Matrix.

Requirement	Strategic Cost Model	DPR Model
Sustainment Incorporation of sustainment costs	- National Procurement data updated after removing O&M amount from DPR, having previously used the "Groves Multiplier" for new capabilities and platforms; Paul Desmier's ratio model[2] implemented in the 2011 version for select projects	- Includes sustainment costs in baseline amounts - Individual IP project costs potentially included on a case-by-case basis - National Procurement data updated after removing O&M amount from DPR.
Personnel - Incorporation of Personnel Costs - Incorporation of recruitment, retention and attrition schedule	- Wage data uploaded from DPM - Recruitment, retention data calculated outside the model using cost template from CFO	- Includes personnel costs in baseline amounts - DPR model generally assumes IP projects do not affect forces personnel levels - In special cases, additional personnel for specific IP projects are included - Does not include incorporation of recruitment / attrition schedule; possible to add
Information Management - Incorporation of IM costs exclusive of Shared Services Canada	- IM costs not attributed to capabilities; gross amount reported at the HQ level	- Includes IM costs in baseline amounts - No mapping to capabilities
Auditability - Uses CFO-endorsed, auditable costing data inputs; traceability of outputs to inputs	- Data up to the 2011 version is based on CFO data but is now out of date - Traceability is poor	- Baseline data pulled from various sources including Cost Factors Manual inputs; difficult to trace unambiguously - New IP projects entered into the model individually can be traced easily
Cash vs. Accrual - Present data in the form of both cash and accrual	- Incorporated and formula based	- Incorporated

Continued on next page

---

[2] See, for instance, Paul Desmier (2016) [3].

Requirement	Strategic Cost Model	DPR Model
Exchange Rates and Inflation - Model includes routines to adjust data for changes in exchange rates and inflation as given by the economic model	- Model includes routines for inflation (based on the economic model) but not exchange rate	- DPR model includes a routine to apply inflation and exchange rate deviations - Does not include risk due to exchange rate / inflation changes as described in the Cost Risk Framework - Individual projects sometimes use "baked-in" inflation and exchange rate projections which deviate from the rates applied broadly within the model
Cost Breakdown Structure - Input data presented using the standard Cost Breakdown Structure	- Input data follows own high level LCC but not standard CBS	- Baseline data attributed arbitrarily to the CBS - Individual IP projects mapped to the CBS
Force Development and Capability-Based Planning - Model links to performance management and central agency (Treasury Board, Finance) reporting standards	- Not designed nor adaptable	- Model designed specifically for support of DPR, and so focuses on decision analysis - Questionable capacity for performance management / reporting standards in its current form
Documentation - Up-to-date documentation of the model framework including ground rules and assumptions	- Three documents covering the 2005 and 2007 versions of the model - Documentation exists for the Microsoft Access version of the SCM but requires update	- Includes a set of four documents covering the main aspects of each of the data input, consolidation model, options tool, and visualization suite - Documentation on underlying model structure is not comprehensive
Calculation of Indirect Costs - Ability to calculate indirect or overhead costs; PRICIE costs	- Attributes overhead and indirect costs to capabilities, uses PRICIE - Process is clear and traceable but requires update	- All non-IP ongoing costs are included in the baseline and so cannot be accounted for individually - IP projects include manually-entered fixed and variable costs

Requirement	Strategic Cost Model	DPR Model
Risk and Uncertainty - Ability to incorporate uncertainty according to the Cost Risk Framework; i.e., including the use of S-curves and probability distributions - Portfolio-level or other high-level aggregate cost risk analysis	- Capability-level risk was included in earlier versions but this is not included in the most recent version of the model - Possible to include portfolio or capability level analyses: earlier routine was based on @Risk software suite in the Excel version of the model	- Model currently uses an ad-hoc matrix approach that is not compliant with the Cost Risk Framework - Possible to revise model to include proper risk analysis - Can calculate and visualize the aggregate amount of contingency associated with the currently-selected set of projects; no distribution or S-curve on aggregate
Marginal Analysis and IP Decision Analysis - Ability to conduct IP choice and marginal analysis; i.e. examining the impact of changing force elements on overall costs	- Can perform crude analysis of demand-supply comparison by the CFDS four pillars and major projects (2008 version) - No capacity for marginal or trade-off analysis	- Can construct alternate "courses of action" by selecting which new IP projects to include - No capacity for marginal or trade-off analysis
Visualization - Integration of visualization tools within the model or exported to a visualization toolset or software	- Basic graphs that can be generated within Microsoft Excel but very crude and requires considerable time to modify and update	- Uses the Tableau suite of visualization tools, offering a wide variety of visualization options

Abbreviations

CBS: Cost Breakdown Structure

CFDS: Canada First Defence Strategy

CFO: Chief Financial Officer

DPM: Defence Personnel and Operations and Maintenance Model

DPR: Defence Policy Review

IM: Information Management

IP: Investment Plan

LCC: Life Cycle Costing

O&M: Operations and Maintenance

PRICIE: People, Research and Development, Information Management, Concept/Doctrine, Infrastructure, Equipment

SCM: Strategic Cost Model

DOCUMENT CONTROL DATA

*Security markings for the title, authors, abstract and keywords must be entered when the document is sensitive

1. ORIGINATOR (Name and address of the organization preparing the document. A DRDC Centre sponsoring a contractor's report, or a tasking agency, is entered in Section 8.) DRDC – Centre for Operational Research and Analysis Carling Campus, 60 Moodie Drive, building 7S.2, Kanata, ON K1A 0K2, Canada	2a. SECURITY MARKING (Overall security marking of the document, including supplemental markings if applicable.) CAN UNCLASSIFIED
	2b. CONTROLLED GOODS NON-CONTROLLED GOODS DMC A

3. TITLE (The document title and sub-title as indicated on the title page.)   Implications of the Deloitte DPR Model

4. AUTHORS (Last name, followed by initials – ranks, titles, etc. not to be used. Use semi-colon as delimiter)   Penney, C. E.; Solomon, B.; Young, C.

5. DATE OF PUBLICATION (Month and year of publication of document.) August 2018	6a. NO. OF PAGES (Total pages, including Annexes, excluding DCD, covering and verso pages.) 10	6b. NO. OF REFS (Total cited in document.) 3

7. DOCUMENT CATEGORY (e.g., Scientific Report, Contract Report, Scientific Letter)   Reference Document

8. SPONSORING CENTRE (The name and address of the department project or laboratory sponsoring the research and development.)   DRDC – Centre for Operational Research and Analysis   Carling Campus, 60 Moodie Drive, building 7S.2, Kanata, ON K1A 0K2, Canada

9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.) 00bd	9b. CONTRACT NO. (If appropriate, the applicable contract number under which the document was written.)

10a. DRDC DOCUMENT NUMBER DRDC-RDDC-2018-D077	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)

11a. FUTURE DISTRIBUTION WITHIN CANADA (Approval for further dissemination of the document. Security classification must also be considered.)   Public release

11b. FUTURE DISTRIBUTION OUTSIDE CANADA (Approval for further dissemination of the document. Security classification must also be considered.)   Public release

13. ABSTRACT/RÉSUMÉ (When available in the document, the French version of the abstract must be included here.)

In June 2016, ADM Fin contracted Deloitte to aid in providing life cycle cost estimates for the full suite of projects included in the Defence Policy Review (DPR) and to develop a project cost compilation model to allow for high level visibility into the DPR's budgetary impacts. Importantly, this model supplanted the Strategic Cost Model (SCM) which previously acted as ADM Fin's enterprise-level costing model. This Reference Document provides an overview of the functionality of the Deloitte DPR model, compares and contrasts it with the legacy SCM, and discusses the implications of the usage of the Deloitte DPR model as an enterprise-level costing model going forward.

En juin 2016, le SMA(Fin) a retenu les services de Deloitte pour l'aider à fournir des estimations des coûts du cycle de vie pour l'ensemble des projets inclus dans l'Examen de la politique de défense (EPD) et pour élaborer un modèle de compilation des coûts des projets afin de permettre une visibilité générale des répercussions budgétaires de l'EPD. Il est important de noter que ce modèle a remplacé le modèle stratégique de prévision des coûts (MSPC) qui servait auparavant de modèle d'établissement des coûts au niveau de l'organisation du SMA(Fin). Le présent document de référence donne un aperçu de la fonctionnalité du modèle d'EPD de Deloitte, le compare et le met en contraste avec l'ancien MSPC, et souligne les répercussions des implications de l'utilisation du modèle d'EPD de Deloitte comme modèle d'établissement des coûts à l'échelle de l'organisation dans le futur.