



The Strategic Cost Model — 2012

Revised and Updated in Access 2003

R. MacPherson
NOVO Energy, Inc.

The scientific or technical validity of this Contract Report is entirely the responsibility of the contractor and the contents do not necessarily have the approval or endorsement of Defence R&D Canada.

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Defence R&D Canada
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Strategic Planning Operational Research Team
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The Strategic Cost Model — 2012

Revised and Updated in Access 2003

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Abstract

This document is a deliverable associated with the project entitled "Strategic Cost Model Update 2012." This report was completed by NOVO Energy Inc. under Contract 4500840698 to Defence Research & Development Canada Centre for Operational Research and Analysis.

The Strategic Cost Model was developed by CORA scientists to help provide capability cost estimates to other parts of the Department of National Defence and Canadian Forces. The current version of the Strategic Cost Model is "owned" and maintained by Assistant Deputy Minister Finance and Corporate Services, but CORA scientists on the Defence Economics Team continue to provide research and development support to Cost Model users. The current document provides an overview and some detail of the revised and updated version of the Strategic Cost Model delivered under this contract.

Résumé

Ce document est issu du projet de mise à jour du modèle stratégique de prévision des coûts 2012. Ce rapport a été rédigé par la compagnie NOVO Energy Inc. dans le cadre du contrat no 4500840698 confié au Centre d'analyse et de recherche opérationnelle de Recherche et développement pour la défense Canada (RDDC CARO). Des scientifiques du Centre ont élaboré ce modèle afin que d'autres parties du ministère de la Défense nationale et des Forces canadiennes puissent effectuer des estimations de coûts. La version actuelle du modèle est la propriété et la responsabilité du Sous-ministre adjoint (Finances et services du Ministère), mais les scientifiques du CARO faisant partie de l'Équipe de l'économie de la Défense offrent toujours aux utilisateurs du modèle du soutien à la recherche et au développement. Le présent document donne un aperçu de la version révisée et mise à jour du modèle stratégique de prévision des coûts ayant été livré dans le cadre de ce contrat. Certaines précisions y sont également apportées.

Executive summary

The Strategic Cost Model — 2012: Revised and Updated in Access 2003

R. MacPherson; DRDC CORA CR 2013-003; Defence R&D Canada – CORA; January 2013.

Context

The Strategic Cost Model (SCM) is a key Departmental asset which underpins a range of DND planning and analysis activities. The model is owned by ADM(Fin CS) and was (and continues to be) developed by DRDC CORA. The contractor was first retained to document the existing SCM, which was originally implemented as a complex series of inter-dependent Microsoft (MS) Excel spreadsheets that needed to be manually updated and maintained. This maintenance was a cumbersome process, and the imminent departure (retirement) of the CORA scientist most familiar with the model prompted CORA to issue a contract to document the extant SCM and to explore the possibility of updating the SCM.

Updates / Upgrades to the Strategic Cost Model

As outlined above the contract was originally for documentation of the model, not for its use nor necessarily its modification. Early on in the process, the contractor presented a revised version of the SCM that translated the existing SCM functionality from MS Excel to MS Access. MS Access provides a much more flexible and, it turns out, quicker data input and analysis base than the original MS Excel spreadsheets. This revised version of the basic SCM was then upgraded on an on-going basis until the end of the contract period.

Conclusion

It was in the interests of ADM(Fin CS) and CORA that the SCM was supported by up to date documentation ahead of the retirement of the principal scientist supporting this work. The nature of the model, and of this task, changed substantially with the change to MS Access; the maintenance and documentation requirements were greatly reduced from over 100 interlinked spreadsheets with several hundred named regions to a single MS Access database and 7 fairly straightforward master queries. The ADM(Fin CS) representatives recognize the value of the updated and upgraded SCM, and the extent of the documentation delivered given the new ease-of-use, flexibility and transparency of the SCM.

Sommaire

The Strategic Cost Model — 2012: Revised and Updated in Access 2003

R. MacPherson ; DRDC CORA CR 2013-003 ; R & D pour la défense Canada – CARO ; janvier 2013.

Contexte

Le modèle stratégique de prévision des coûts (MSPC) est un bien ministériel essentiel qui sous tend diverses activités d'analyse et de planification du MDN. Élaboré de manière continue par RDDC CARO, ce modèle est la propriété du SMA(Fin SM). Les services de l'entrepreneur ont d'abord été retenus pour documenter le MSPC actuel dont la version initiale consistait en une série complexe de feuilles de calcul Microsoft (MS) Excel interreliées devant être mises à jour à la main. La lourdeur du processus et le départ à la retraite imminent du scientifique connaissant le mieux le modèle ont incité le CARO à émettre un contrat afin de documenter le modèle existant et d'examiner la possibilité de le mettre à jour.

Mises à jour / Améliorations du modèle stratégique de prévision des coûts

Tel qu'il est susmentionné, le contrat visait à documenter le modèle et non pas à l'utiliser ou nécessairement le modifier. Au début du processus, l'entrepreneur a présenté une version révisée du MSPC dans laquelle la fonctionnalité du MS Excel avait été convertie en MS Access. Ce dernier s'est avéré être un logiciel d'analyse et d'entrée de données plus souple et rapide que les feuilles de calcul MS Excel originales. Depuis cette version révisée du MSPC de base, une mise à jour périodique a été effectuée jusqu'à la fin du contrat.

Conclusion

Il était dans l'intérêt du SMA(Fin SM) et du CARO que le MSPC soit appuyé d'une documentation à jour avant le départ à la retraite du scientifique principal dans le cadre de ce travail. La conversion en MS Access a grandement modifié la nature et la tâche de ce modèle. Les exigences relatives à la documentation et à la mise à jour ont fortement diminué, passant de plus de cent feuilles de calcul interreliées avec des centaines de régions désignées à une seule base de données MS Access et sept demandes principales assez simples. Les représentants du SMA(Fin SM) reconnaissent la valeur de cette mise à jour, de même que l'ampleur de la documentation obtenue grâce à la convivialité, à la souplesse et à la transparence du nouveau MSPC.

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1 Introduction

1.1 Explanation of the Project Evolution

This project originated as a Defence Research and Development Canada (DRDC) Center for Operational Research and Analysis (CORA) tasking to document and explain the functioning of the Strategic Cost Model (SCM) as implemented in Microsoft™(MS) Excel™(2003 version) on the Defence Wide Area Network (DWAN). The DWAN is the daily operational network used throughout the Department of National Defence (DND) and Canadian Forces (CF).

The SCM at the time the contract was issued consisted of a large number (more than 100) interlinked spreadsheets that served as the tool that enabled Assistant Deputy Minister (ADM) Finance and Corporate Services (Fin CS) staff to produce capability costings for use in various strategic-level planning exercises, including the Investment Plan produced by Chief of Programme (CProg) and the Force Capability Plan (FCP; formerly the Strategic Capability Roadmap (SCR)) of Chief of Force Development (CFD). These organizations are both part of the Vice Chief of Defence Staff (VCDS) group within DND / CF. The original SCM is well-documented elsewhere [1, 2, 3, 4].

During the course of fulfilling the contract requirements, the contractor and the Technical Authority (TA) realized that significant benefits could be realized by translating the MS Excel™version into MS Access™. The amount of work involved was actually less than it would have been to document the older version of the SCM, and the resultant MS Access version would be much faster both in computing the cost estimates and in adapting to changing demands from the small user group (ADM(Fin CS) staff).

The rest of this document is the Contractor's Report on the revised SCM, implemented in MS Access™2003¹ and tested and accepted as accurate by both the DRDC CORA TA and the ADM(Fin CS) project sponsors.

1.2 Documentation Limitations

It is recognized that the documentation provided herein is not provided in a format that is readily accessible to a novice MS Access™2003 user. There is an assumption that interested readers have a strong understanding of Visual Basic for Applications (VBA) and Structured Query Language (SQL), as the power of the new implementation of the SCM is that it reduces the processing time by reducing the over 100 interlinked spreadsheets to seven (7) complex SQL queries operating on temporary data tables. While the accompanying documentation is not overly complex for skilled database users, and serves to explain the functionality appropriately for that group, it is fully recognized that the relatively naive spreadsheet user will NOT be able to use the new version of the SCM without expert assistance.

¹The actual delivered version is available in MS Access™versions 2003, 2007 and 2010; only the 2003 version is discussed hereafter as the DWAN currently (2012) only supports MS Office™2003.

2 How To Use This Document

2.1 Chapter 2 - How To Use This Document

Chapter 2 is a directional guide to using this document and provides an overview of each section - as users need only consult individual sections.

2.2 Chapter 3 - Architectural Overview

Chapter 3 provides an architectural overview of the SCM system from a data and application perspective. It also provides information about the minimum system requirements and performance considerations.

This chapter is important for someone new to the SCM model, yet assumes a robust knowledge of National Defence acronyms and terminology, Finance methods, Capability Based Planning and of the functions and features of MS Excel and MS Access.

2.3 Chapter 4 - Source File Fields and Rules

Chapter 4 describes each of the source data sheets, source data fields, and the rules associated with each field. It also describes how manipulating the source data will affect the performance and results of the SCM processing.

It is essential that the rules associated with each Table and Field be respected as any deviation will almost certainly cause results to be erroneous or cause the SCM Processing in MS Access to fail.

2.4 Chapter 5 - SCM Processing in MS Access

Chapter 5 provides a basic description of each Table and Query and provides the sequence of steps to be followed when processing a new set of source data.

2.5 Chapter 6 - Analyzing Results

Chapter 6 is broken into two sections. Section 1 discusses some options for conducting analysis directly in MS Access. Section 2 discusses the basis for conducting Pivot Table analysis in MS Excel

2.6 Chapter 7 - Future Development and Direction

Chapter 7 discusses future considerations that may impact the evolution and direction of the SCM model.

3 Strategic Cost Model Architecture

Figure 1 is a depiction of the primary architecture of the SCM.

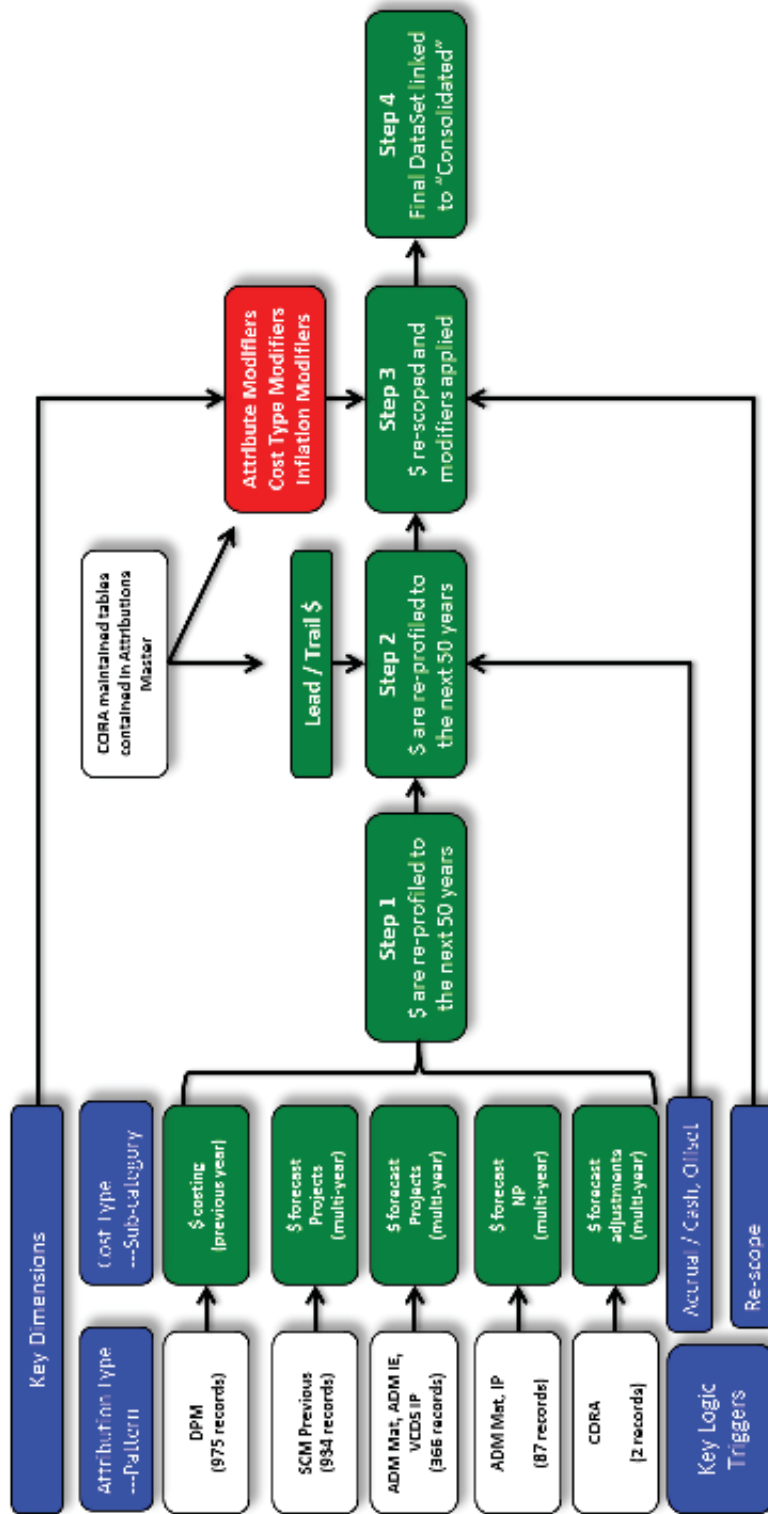


Figure 1: Strategic Cost Model Architecture Overview

4 SCM Source File Fields and Rules

The following tables will provide a definition for, and describe the function / rules associated with every column being imported from MS Excel. Two overarching rules are that the Column Name and DataType properties can not be altered without potentially affecting the functioning of SCM- and thus should only be done by someone knowledgeable in MS Access programming.

It is important to note that the SCM MS Access Processing provides no facility for direct data input, all data input must be facilitated through these tables.

This definition file has been prepared in accordance with the structure in effect as of Version 6 of the SCM Model.

4.1 Source - Consolidated Table

This file is the source of the costing data.

Table 1: Field Definitions - Source Consolidated Table of SCM 2012

Column Name	Definition	Data Type	Rule
L1	Per DND	Text	
Environment	Per DND	Text	
FPC1	Per DND	Text	
FPC2	Per DND	Text	
Attr_Ref	This code corresponds with Attribution Type and is the key Relationship for controlling Indirect Attribution	Text	One to One with Attribution Type
AttributionType	Per DND definition [1, 2]	Text	One to One with Attribution Ref
FGE_Type	Per DND definition [1, 2]	Text	
SC\$_\$ID	This is the unique identifier for every record in the table	Text	Primary Key - Must be a Unique Value
Sub-Category	Per DND definition [1, 2]	Text	
UIC_PROJ_ID	Per DND definition [1, 2]	Text	
UIC_PROJ_NAME	Per DND definition [1, 2]	Text	
UIC_PROJ_LOC	Per DND definition [1, 2]	Text	
Fund	Per DND definition [1, 2]	Text	
Cost_Type	Per DND definition [1, 2]	Text	
Cost_Sub-Type	Per DND definition [1, 2]	Text	
Pillar	Per DND definition [1, 2]	Text	
Pillars_Tag	Per DND definition [1, 2]	Text	
Capital_Lifetime	Per DND definition [1, 2]	Text	
DataSource	Per DND definition [1, 2]	Text	
MilPY	Per DND definition [1, 2]	Double	
CivPY	Per DND definition [1, 2]	Double	
ResPYA	Per DND definition [1, 2]	Double	
ResPYB	Per DND definition [1, 2]	Double	
ResPYC	Per DND definition [1, 2]	Double	
Equip	Per DND definition [1, 2]	Double	
fxxx	Per DND definition [1, 2]	Currency	

4.2 Source - Indirect Attribution Table

This file controls how indirect costs are attributed.

Table 2: *Field Definitions - Source Indirect Attribution Table of SCM 2012*

Column Name	Definition	Data Type	Rule
Attr_Src	Attribution Type Code of the Source of Cost being distributed	Text	Must correspond with exact code in Consolidated
Driver	Driver Description	Text	
Attr_Dest	Attribution Type Code of the destination of the cost distributed cost	Text	Must correspond with exact code in Consolidated
Quantity	Driver Quantity	Double	
Attribution%	Calculated Percentage	Double	Total for each group of Attribution Sources must equal 1

4.3 Source - Level Of Detail Table

This file controls the level of detail for small value records and has a significant impact on performance and database size.

Table 3: *Field Definitions - Source Level Of Detail Table of SCM 2012*

Column Name	Definition	Data Type	Rule
LowDollarMax	Specifies the upper threshold of below 0 dollar amounts	Double	Must be less than 0
HighDollarMin	Specifies the lowest threshold of above 0 dollar amounts	Double	Must be more than 0
QuantMin	Specifies the lowest threshold of above 0 quantities	Double	Must be more than 0
Stage	Stage at which filters are applied	Text	
Dumblink	Used to link file to query	Text	

5 SCM Processing in MS Access

5.1 Tables and Query Descriptions

Table 4 describes each of the objects in the MS Access system, in order of precedence.

Table 4: MS Access Table and Query Descriptions for SCM Processing

Object	Type	Function
Source_Consolidated	Table	Source
Source_IndirectAttribution	Table	Source
Source_LevelOfDetail	Table	Source
z_UnpivotAmounts	Union Query	Denormalizes Source_Consolidated
01_MakeIndirects_0	Make Table Query	Creates Int_Indirect_0
Int_Indirect_0	Table	Source for Staged Queries
03_Stage1	Select Query	Based on Indirect_0
04_Stage2	Select Query	Based on Stage 1
05_Stage3	Select Query	Based on Stage 2
06_Stage4	Select Query	Based on Stage 3
07_Stage5	Select Query	Based on Stage 4
08_Stage6	Select Query	Based on Stage 5
Z_ConsolidateCosting	Union Query	Consolidates Stages 1 through 6
02_1_MakeFinalCost	Make Table Query	Writes results of costing to Final Costing
Final_Costing	Table	Contains Results of Costing
02_2_AppendDirect	Append Query	Appends Direct Costs
Final_Dimensioned	Select Query	Re-applies information dimen- sions
D_CostType	Select Query	Shows Cost Type Dimension
D_FGE	Select Query	Shows FGE Dimension
D_Pillar	Select Query	Shows Pillar Dimension
D_Unit_Project	Select Query	Shows Unit Dimension

5.2 Step 1 - Import Files and Set Indexes

The initial step is to import the three source worksheets from SCM_SourceVx.xls

- Source_Consolidated
- Source_IndirectAttribution
- Source_LevelOfDetail

To avoid the need to manually create indexes, the user should delete all the records in the existing Source_Tables in Access, and append these sources into the tables. This will ensure that the structure of the source tables is maintained and indexes are appropriate. If the tables have been deleted, the user needs to ensure that the data types specified in Section 3 of this document are specified during the import process.

Once the import is complete, the user should create indexes on the following fields to improve system performance.

- Attr_Ref
- Attr_Src
- SC_ID

5.3 Step 2 - Execute Make Tables and Set Indexes

The user then needs to run a 3 part process to create the intermediate and final costing tables.

- 01_MakeIndirects_0 - this will create "Int_Indirect_0" Once this file has been created the user should open it in design view and set Indexes on Attr_Ref and SC_ID to improve system performance
- 02_1_MakeFinalCost - this creates "Final_Costing" This step in the process can take from 3 minutes to as much as an hour or more depending on the number of source records and the materiality threshold set in Source_LevelOfDetail
- 02_2_AppendDirect - this appends the direct costs to "Final_Costing"

As an alternative, the user can simply run the AutoExecute macro - this however eliminates the opportunity to set the index on the "Int_Indirect_0" table and could cause significant performance delays.

5.4 Step 3 - View Results

By running the "Final_Dimensioned" Query, the user can view the full results table.

6 Analyzing Results

6.1 MS Access Analysis

The core file for analysis of results is Final_Costing. By linking this file with the various "Dimension" Queries the user could generate discrete views of the data.

6.2 MS Excel Analysis

It is best to open a new worksheet and configure a pivot table report to connect directly to the "Final_Dimensioned" Query. Table 5 provides a description of the fields.

Table 5: Description of Fields in the Output Table of the SCM

FieldName	Description
SC_ID	The final “dimensioned” file is linked on SC_ID
Attr_Src	This will say "Direct" or Provide the Indicator of the Source Element
Attr_Dest	This will only contain Direct FGE elements
FY	Fiscal Year
Cost	Costed Amount
Stage	Stage at which cost was assigned
QUANTYPE	Quantity Type
AllocQty	Allocated Quantity Amount
L1	Dimension Data Based on the SOURCE of the cost
Environment	Dimension Data Based on the SOURCE of the cost
FPC1	Dimension Data Based on the SOURCE of the cost
FPC2	Dimension Data Based on the SOURCE of the cost
Attr_Ref	Dimension Data Based on the SOURCE of the cost
AttributionType	Dimension Data Based on the SOURCE of the cost
FGE_Type	Dimension Data Based on the SOURCE of the cost
[Sub-Category]	Dimension Data Based on the SOURCE of the cost
UIC_PROJ_ID	Dimension Data Based on the SOURCE of the cost
UIC_PROJ_NAME	Dimension Data Based on the SOURCE of the cost
UIC_PROJ_LOC	Dimension Data Based on the SOURCE of the cost
Fund	Dimension Data Based on the SOURCE of the cost
Cost_Type	Dimension Data Based on the SOURCE of the cost
[Cost_Sub-Type]	Dimension Data Based on the SOURCE of the cost
Pillar	Dimension Data Based on the SOURCE of the cost
Pillars_Tag	Dimension Data Based on the SOURCE of the cost
Capital_Lifetime	Dimension Data Based on the SOURCE of the cost
DataSource	Dimension Data Based on the SOURCE of the cost
UIC_PROJ_LOC	Dimension Data Based on the SOURCE of the cost
Fund	Dimension Data Based on the SOURCE of the cost
Cost_Type	Dimension Data Based on the SOURCE of the cost
[Cost_Sub-Type]	Dimension Data Based on the SOURCE of the cost
Pillar	Dimension Data Based on the SOURCE of the cost
Pillars_Tag	Dimension Data Based on the SOURCE of the cost
Capital_Lifetime	Dimension Data Based on the SOURCE of the cost
DataSource	Dimension Data Based on the SOURCE of the cost

7 Future Developments

7.1 Error Checking

The introduction of new data elements always introduces the risk of failure in SCM and thus more error checking routines could help in future iterations.

7.2 Automation

Once the system is functioning with actual source data- more automation around importing, indexing and results generation could be introduced.

7.3 Defence Personnel, Operations and Maintenance Model

In theory, the scope of the Strategic Cost Model could be expanded to address the processing requirements of the Defence Personnel, Operations and Maintenance Model, which is currently done

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List of abbreviations

ADM	Assistant Deputy Minister
CDS	Chief of the Defence Staff
CF	Canadian Forces
CORA	Center for Operational Research and Analysis
CProg	Chief of Programme
DM	Deputy Minister
DND	Department of National Defence
DPM	Defence Personnel, Operations and Maintenance Model
DRDC	Defence Research & Development Canada
DWAN	Defence Wide Area Network
FCP	Force Capability Plan
Fin CS	Finance & Corporate Services
L1	Level 1 – The first level of DND/CF leadership below the DM and the CDS
MS	Microsoft ©
SCM	Strategic Cost Model
SCR	Strategic Capability Roadmap
SQL	Structured Query Language
UIC	Unit Identification Code
VBA	Visual Basic for Applications
VCDS	Vice Chief of the Defence Staff

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