High-Level Costing Models within the Technical Cooperation Program Nations

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Prepared for:
TTCP JSA TP 3, Focus Area 4 – High-Level Costing

Defence Research and Development Canada

Reference Document
DRDC-RDDC-2017-D058
June 2017

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Abstract

This Reference Document captures the work completed by the author under the Technical Cooperation Program (TTCP) Joint Systems and Analysis (JSA) Group umbrella prior to its cancellation. It is an incomplete work that was initially intended to deeply compare different high-level costing models and suggest a new strategic costing framework for the TTCP nations. As a result it is limited to providing a preliminary comparison of four different high-level costing models from four TTCP nations. It also describes the foundation of an approach to high-level costing which could be used in the new framework.

Résumé

Ce document de référence contient le travail réalisé par l'auteur dans le cadre du groupe d'Analyse des systèmes communs du Programme de coopération technique (PCT) avant sa dissolution. Il s'agit d'un travail inachevé qui avait pour but à l'origine de comparer en profondeur divers modèles de prévision des coûts stratégiques et de proposer un nouveau cadre en la matière. Ce document ne présente, de ce fait, qu'une comparaison préliminaire de quatre modèles de coûts issus des pays du PCT. On y trouve également une description de certains principes de base pouvant servir à l'élaboration d'un nouveau cadre de prévision des coûts stratégiques.

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Acknowledgements

I would like to acknowledge the substantial input received from the TTCP JSA TP 3 FA 4 members. I sincerely thank them for their dedication and collaboration. I want also to take the time to thank Dr. Chad Youg for his input and his thoughtful comments and suggestions.

1 Introduction

The Focus Area 4 (FA4) on high-level costing within the Technical Cooperation Program (TTCP) Joint Systems and Analysis (JSA) stood up in May 2015. FA4 was established and monitored by the Technical Panel 3 (TP 3) as an opportunity for scientific collaboration and cost sharing among the TTCP nations towards the development of a generic high-level costing framework. The aim of the future strategic costing framework was to help each TTCP nation understand how its costing approach compares to those of other nations.

The work was organized into three phases: In Phase 1, a review of the literature on to high-level costing models was conducted, a common taxonomy of terms was developed, and a cost model characterization survey was completed. The intent was to follow this with Phase 2, where a generic high-level costing framework would be developed and Phase 3, where a substantive report on strategic costing would be submitted [1]. In September 2016 and prior to Phase 2, the TTCP Principals decided that JSA Group should close.

The aim of FA4 was to develop a common framework to help individual nations validate and/or improve their models and approaches for strategic costing in a Defence environment. Analyzing existing models and costing approaches such as Activity-Based Costing (ABC) within the TTCP nations was considered as a starting point from which to build a common framework.

This Reference Document describes what was intended to be the Canadian preliminary contribution to TTCP JSA TP 3-FA 4 prior to its cancellation. The document is organized into five sections. Following the introduction, Section 2 presents the key characteristics of the Canadian costing framework. In Section 3, four costing models within the TTCP nations are compared in a structured way. Section 4 describes the foundation of ABC, its assumptions, its steps, and its known limitations. Section 5 provides some concluding remarks.

2 The Canadian Strategic Cost Model

To ensure consistency in information provided, Young [2] prepared a list of survey questions to be answered for each national costing approach. These questions are provided in Annex A. The Canadian answers to these questions are used in this section to portray the Canadian Strategic Cost Model (SCM). The Canadian answers are predominantly based on References [3–5] and can be found in Reference [6].

2.1 Utility

The survey questions related to model utility seek to understand (1) the purpose for which the model has been developed; (2) the kinds of questions it is expected to answer; and (3) who the model's main stakeholders are.

2.1.1 The Purpose for which the Model has been Developed

The espoused objectives of the SCM are to help shape defence plans and to inform programming, investment and budgetary decisions. Within this context the SCM aims to help the Department of National Defence (DND) and the Canadian Armed Forces (CAF) create better alignment between their costs, activities and outputs in accordance with national objectives.

When the SCM was developed, it was intended to do the following:

- Estimate macro-level costs in association with the Defence Policy Statement in 2005/6.
- Estimate macro-level costs associated with force element groupings for the Defence Capability Plan (DCP).
- Provide a baseline structure for conducting cost/effectiveness analysis with respect to different force structures.

2.1.2 The Kinds of Questions It is Expected to Answer

The SCM was designed to help answer to the following types of questions:

- What are the estimated full costs (over time) of adding particular force elements to the force structure?
- What are the macro-level cost implications (over time) of increasing the population of military personnel by certain amounts?

The model has been involved in the assessments of full costs associated with major capital acquisitions and the establishment of military personnel size.

2.1.3 The Main Stakeholders in Connection with the Model

The main stakeholders for the model are as follows:

- ***Developers***—Members of the Strategic Planning Operational Research Team (SPORT), within the Centre for Operational Research and Analysis (CORA), which is a subordinate organization under Defence Research and Development Canada (DRDC).
- ***Maintainers***—Staff within the Centre for Costing in Defence (CCD), an organization within the Assistant Deputy Minister Finance organization ADM (Fin).
- ***Data/Content Owners(s)***—Centre for Costing in Defence (CCD).
- ***Users***—Staff within the Vice Chief of the Defence Staff organization (VCDS). This includes staff from the Chief of Force Development (CFD) organisation. Other users are staff within the ADM (Fin) and DRDC CORA.
- ***Support***—User support is provided on an ad-hoc basis by staff from CCD and analysts from DRDC CORA.

2.1.4 The Impact that It has Had

As a management costing tool, the SCM has been used to:

- estimate budget demands against budget supply projections during development of the 2008 version of the Canada First Defence Strategy;
- calculate expected cost increases due to changes in the cost of resources (e.g., personnel costs, materiel related costs); and
- assess the costs associated with expanding the size of the Canadian Forces from 65K to 75K.

2.2 Methodology

2.2.1 Costing Approach

The SCM estimates long–range costs for planning purposes rather than shorter range costs for programming and budgeting. It is a management costing tool and not a financial reporting tool. As such, full costs in this model include direct and indirect costs and costs associated with the PRICIE components (i.e., **P**ersonnel; **R**esearch and Development (R&D); **I**nfrastructure and Organization; **C**oncepts, Doctrine, and Collective Training; **I**nformation Systems; and **E**quipment, Supplies and Services).

A fundamental aspect of the SCM is its underlying network of cost objects. More specifically, input data for the SCM is organized into approximately 300 departmental cost centres and 400 capital and infrastructure projects. The majority of these objects are organizational entities like bases, training schools, equipment maintenance workshops, and military units. These objects are related to one another via supported/supporting relationships. The relationships between objects in the SCM are characterized by cost attribution rules. The full cost of each object in the network is computed by adding its direct expenditures with costs that are attributed to it from other objects in the network.

2.2.2 Principles

The SCM rests on the following set of ideas.

Full absorption costing—The SCM allocates the entire defence budget to force elements with the exception of headquarters costs, which are not attributed.

Input-Output methodology—Inputs are estimated in fixed proportion to the outputs they help deliver. Cost attributions remain fixed across time.

Time horizons—Cost estimates extending to 20 years in the future (and potentially beyond) should be estimated.

Normal vice Special Costs—Only "normal costs" are accounted for, costs associated with "special programs" should not be accounted for.

Manual vice Automatic optimization—The SCM cannot perform constrained optimization. It cannot conduct balance of investment analysis.

Linearity—Costs are assumed to rise in proportion to demand in a linear fashion via attribution rules.

Depreciation—Straight line or stepwise depreciation is applied to capital acquisitions in order to amortize certain costs and enable accrual budgeting estimates.

2.2.3 Data Sources

To make use of the SCM raw data must be manually extracted from a variety of sources and then pieced together—a highly laborious process. The main sources of data for personnel and Operating and Maintenance (O&M) expenditures are:

- The DND Financial and Managerial Accounting System (FMAS)
- The DND Personnel and O&M Model (DPM)
- The cost factors manuals

The main sources of data for future capital projects are:

- The Capability Investment database
- The National procurement (NP) database

The source of data for grants and contributions is:

- The funding supply database

2.3 Limitations

Although useful, the SCM presents the following deficiencies.

Input Data—The SCM is not a single software tool that an analyst can run to easily produce a standard set of updated results. As stated by Gardner [7], the SCM requires several comprehensive data collection and integration efforts in order to create the required data input (i.e., direct expenditure information for each object). After loading this input data, cost aggregation computations are executed, and then subsequent effort is also required to extract and post process cost results. Of these efforts, obtaining and compiling reliable input data has continually been a great challenge—and this challenge must be overcome each time the SCM is used.

Summary reports—It is often difficult to extract the costs of some entities from the SCM, even if the model captures the information completely. In other words, extracting data from the model and using it to develop reports is not always a straightforward task.

Marginal analysis—The SCM does not do marginal analysis very well. It is useful for assessing the full costs of adding an entirely new capability, but it is not as useful when estimates are required to assess marginal cost increases or savings that would or could be realized if the force structure was incremented or decremented in increments.

Static Attributions—Cost attribution rules in the SCM are based on computing percentages. The proportion of costs accumulated by the entities that a particular object supports has remained fixed since the SCM's original construction. However, as objectives change and new questions arise, the granularity/fidelity of the SCM, may or may not remain appropriate.

Implementation—The SCM is implemented in Microsoft Excel and spans across many linked spreadsheets. Data require varying degrees of pre-processing before being implemented as Excel spreadsheets and visualizations are not directly produced by the model. Moreover, the spreadsheets become very effort-intensive to maintain after years of use.

Uncertainty—The SCM does not conduct sensitivity analysis or uncertainty analysis.

3 Preliminary Comparison of High-Level Costing Models within the TTCP Nations

Four different high-level costing models are compared in this section in terms of utility, implementation, and prevalent deficiencies. These models are [8–10]:

- the Capital Integration Tool (CIT) from New Zealand (NZ),
- the Preparedness Business Intelligence and Management Audit (PBIMA) from Australia,
- the Force Structure Cost Model (FSCM) from United Kingdom (UK), and
- the Strategic Cost Model (SCM) from Canada.

3.1 Utility

As stated in Table 1, the NZ CIT is an Excel model that integrate the costs of all current and planned capability projects. It provides a consolidated picture and enables sensitivity analysis. The Australian PBIMA is a relational database model that calculate the full costs of force elements based on cost centres. The UK FSCM is a high level costing tool that is assists the British Ministry of Defence (MoD) with an improved financial analytical capability. The Canadian SCM provides attributions and cost information that links intermediate outputs such as training, infrastructure and materiel support, and R&D, to elements of the force structure.

Table 1: *Model utility.*

Model	SCM	FSCM	PBIMA	CIT
Why	To estimate macro-level costs to support capability-based planning processes.	To support high level operational analysis studies.	To estimate long-term force element costs.	To consolidate the outputs of the Navy, Land, Air and Enablers models.
How	By constructing a network of organizational entities like bases and supported/supporting relationships between them. The full cost of each entity is computed by adding its direct and indirect expenditures.	By mapping costs to either direct force elements, to shared elements or to overhead elements. Costs are split in proportion to asset values and personnel quantities.	Using direct and indirect (sustainment and facilities) attribution based on cost centre.	By applying the system foreign exchange rates and escalating the value up to the expected time of expenditure.

3.2 Implementation

Table 2 shows that the four models have different levels of maturity varying from two years for CIT to more than 14 years for FSCM. The models use different sources of data on personnel, infrastructure, support cost, finance, and future capital projects. The four models are implemented in Microsoft Excel. This software is used to manipulate the input data, store the model's content, and execute cost computations. It is typical for output to be imported into Excel for purposes of post processing, follow-on analysis, and the production of graphs, tables and charts [6]. There is, however, ongoing development to improve the user interface and the quality of historical cost information.

Table 2: *Model implementation.*

Model	SCM	FSCM	PBIMA	CIT
Data Sources	The model uses different sources of data on personnel and O&M expenditures, finance, future capital projects, and grants and contributions.	Equipment Procurement Plan, Equipment Support Plan, Personnel quantities, Defence Infrastructure, Organisation	The model uses different sources of data on cost centres, expenditures, and attribution rules.	Data comes mainly from the support Cost models. Other data sources are also used.
Software Tools	Two versions: Microsoft Excel and Access.	Inputs are obtained in the form of Excel Spreadsheets requiring pre-processing before being implemented into the model. Data is usually extracted via database queries.	Data base is SQL Server. Data can be exported to Microsoft Excel.	This model is built in Microsoft Excel.
Maturity	The SCM was delivered in 2005 and has been slowly upgraded since then.	The model has been in existence in a mature form for more than 14 years and has been used to support a wide range of analysis studies also strategic force structural decisions	The project started in June 2011.	This model has been in existence for around two years.

3.3 Prevalent Deficiencies

The four models have some limitations which if overcome could significantly enhance their functionality, usability and utility.

- ***Documentation***—The four models do not have adequate documentation on the input data and the corresponding cost estimating relationship (CER). A CER is a statistical relationship developed between historical costs and program physical & performance characteristics [11].
- ***Implementation***—The four models are implemented in Microsoft Excel. After several years of use the spreadsheet version became overly cumbersome to use and very effort-intensive to maintain.
- ***Uncertainty analysis***—The four models don't adequately conduct sensitivity or uncertainty analysis to see what would happen to the different costs if the major sources of uncertainty vary.

Table 3: *Model limitations.*

Model	SCM	FSCM	PBIMA	CIT
Deficiencies	- Inadequate documentation - Difficulty to create certain summary reports - Difficulty to conduct marginal analysis - Static Attributions - Uncertainty	- Reliability and occasional inconsistency of data sources - Inability to generate Whole Life Costs - High level of expertise to update the model	- It is not designed for attributable or marginal costing. - No model for the Army - Different data sources	The model is reliant on other models and there is a high level of fidelity required from those sources.
Exclusions	- The benefits of programs. - It does not adjust attribution fractions in response to organizational change. - Costs associated with special programs.	- Operational costs - Commercial services - Revenue obtained from other government departments or from other Nations - Activity costs (e.g. individual exercises)	- Acquisition costs - Future costs	

4 The Activity-Based Costing Model

Traditional costing methods derive the total cost of products or services by summing all their costs during the production cycle [12]. These methods allocate indirect costs, or overhead costs, on the basis of one driver (e.g. direct labour or machine hours). It has been demonstrated that these methods are inaccurate and misleading as they may allocate too much cost to one product and not enough to another [13]. If indirect costs are allocated to the products using direct labour as a single cost driver, for example, traditional cost methods would allocate too much cost to the labour intensive products and not enough to the machine-intensive ones. Traditional methods use also less cause-and-effect relationships in assigning costs.

ABC was introduced by Cooper [14] and Cooper and Kaplan [15] to overcome this limitation. It measures the cost and performance of process-related activities [16]. ABC estimates indirect costs by using activities as a distributor of cost assignment. It shows how activities performed in the creation of a product or service actually impact the cost ([12], [17]). ABC deviates from traditional costing methods which tend to group costs with less emphasis on causality [18–19]. This costing system can also serve as a useful information system to improve productivity and support strategic decision-making [13].

Table 4 shows some typical differences between ABC and traditional costing methodology [12].

Table 4: *Comparison between ABC and traditional costing methodology.*

	Traditional costing	**Activity-based costing**
Complexity	Straightforward for organizations with one product/service	More technical and time consuming
Orientation	Structure-oriented	Process-oriented
Consumption	Assumed that cost objects consume resources	Assumed that cost objects consume activities
Allocation	Utilizes volume related allocation	Uses drivers at various levels
Overheads	Allocates overheads first to individual departments	Assigns overheads to each activity first

4.1 Assumptions of ABC

In contrast to conventional costing systems that depend on consumption of resources by products, the ABC model depends on consumption of resources by activities [20]. It is a process-based model in which cost of the system is based on costs of individual activities [21]. As such, it should be able to explain any variation in costs based on activity consumption. It may be seen as an organizational effectiveness framework. Three main assumptions inherent in the ABC model are generally stated in the literature [22], and can be presented as follows:

1. Activities can be identified and measured.

2. Activities consume resources.

3. Products or customers consume activities.

In a nutshell, the ABC theory states that products/customers generate activities, activities generate costs, and therefore costs should be assigned to the products/customers based on the activities [20].

4.2 ABC Techniques

ABC techniques can be separated along methodological lines into two main approaches: cost-assignment method and process management view. Each one can be described as a two-stage methodology ([20], [23]).

As shown in Figure 1, in the first stage, the cost-assignment method allocates expenses to activities using resources.

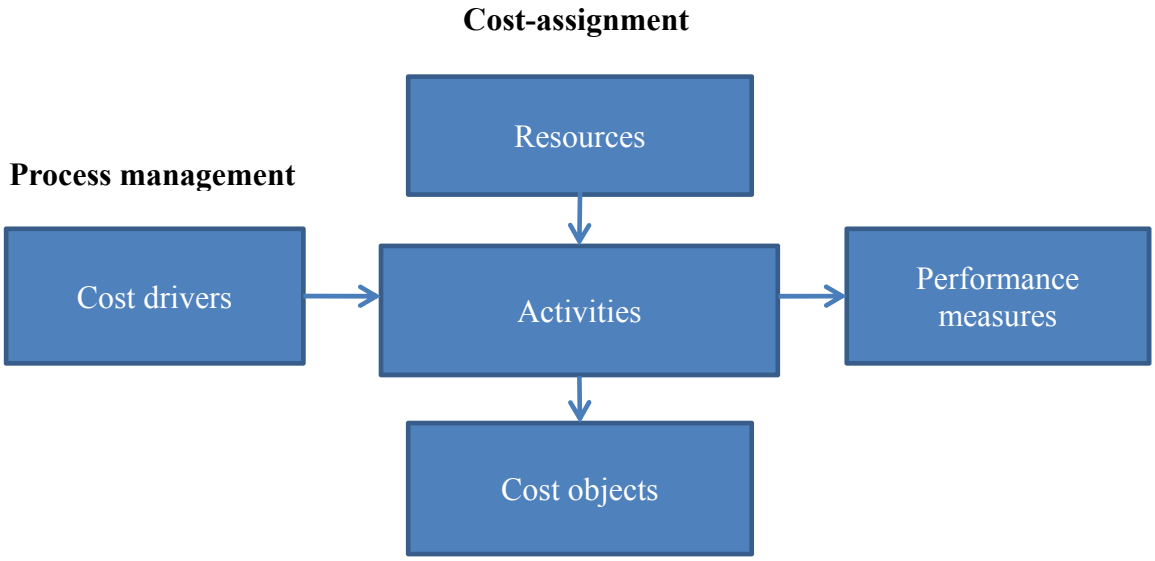

***Figure 1**: Cost-assignment and process management methods—adapted from [13].*

In the second stage, costs are assigned to cost objects (to what or for whom work is done) using activities. This process management view uses cost drivers in the first stage to identify what causes work. It uses performance measures in the second stage to show how well work is done [13].

The use of these cause-and-effect approaches shifts the ABC value from a simple measurement indicator to a management decision support system [24]. Combined, these two approaches would ensure reducing costs, while improving the strategic position of the organization [22–23].

4.3 Steps for Implementing ABC System

As discussed previously, there are three basic phases required to implement a cost-assignment system [25]:

1. Identify resource cost and activity.
2. Assign resource costs to activities.
3. Assign activity costs to cost objects.

More specifically, these phases may be divided into different detailed steps ([19], [21], [26]):

1. Identify the cost centres (the resources to be used directly for producing the end product).
2. Analyze indirect costs and calculate their cost driver rates.
3. Assig resources for each cost centre and determine cost-centre driver rules.
4. Identify activities for each cost centre.
5. Find total cost of each activity.
6. Define activity drivers for each activity.
7. Estimate marginal cost parametrically.
8. Prepare management report where the overhead costs are combined with direct costs to show how well work is done [19].

5 Limitations of ABC

Many reservations have been expressed regarding the decision-making relevance of ABC [27] and its costly design [28]. Many practitioners and academic researchers have noticed that ABC methods too often have yielded less than the desired results [29]. ABC seems to be too long to implement, too expensive to build and maintain, and unable to capture the complexity of operations [30–31]. Studies of ABC use have reflected this dissatisfaction with the technique. In the UK's largest companies, Activity-based management (ABM) was used 52% in 2005, with an associated satisfaction score below the average for all tools used. This relatively low adoption rate has been consistently observed in different countries [31].

To facilitate in the implementation of an ABC model, Kaplan and Anderson [30] developed a cost driver method called time-driven activity-based costing. This method requires less time and resources to implement. Its main peculiarity compared to ABC is the use of time equations for each activity. As shown in Equation (1), the time t_j spent on activity j can be estimated as a function of the number of units of the corresponding time driver, x_d. β_0 and β_d are the equation parameters (or coefficients).

$$t_j = \beta_0 + \beta_d x_d. \tag{1}$$

These coefficients can be estimated from historical data or from experience. A time equation may have multiple time drivers for each activity [32].

6 Conclusion

This Reference Document captures what was intended to be the Canadian preliminary contribution to TTCP JSA TP 3-FA 4 prior to its cancellation. The information collected in this document could be useful when developing any new high-level costing framework, through providing a preliminary comparison of four different high-level costing models and describing the theoretical foundation of ABC.

The comparison of the high-level costing models seeks to understand: (1) the purpose for which each model has been developed, (2) the kinds of questions it is expected to answer, (3) who the main stakeholders in connection with the model are. It also describes the implementation of each model in terms of data sources, software tools, and maturity. The comparison identified some deficiencies in the four models that need improvement. These deficiencies include (but not limited to):

- Insufficient documentation on the input data and CERs,
- Effort-intensive implementation, and
- Inability to adequately conduct sensitivity and uncertainty analyses.

ABC was suggested by many researchers as a high-level costing approach to put more emphasis on causality. This approach estimates indirect costs by using activities as a distributor of cost assignment. It deviates from conventional costing methods by measuring the cost and performance of process-related activities. However, the conventional ABC takes too long to implement and is too expensive to build. To facilitate the implementation of a common strategic costing framework within the TTCP nations, it is recommended to use time-driven ABC. This approach uses time equations and requires less time and resources to implement.

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References

[1] Young, C. ADM(S&T)/DRDC CORA (13 May 2015, 1610 EST). FA4 Work Stream 1 – A Strategic Costing Framework for Bench Marking & Validation. Unpublished document.

[2] Young, C. (2015). High Level Cost Model – Survey Questions Part I. TTCP JSA TP-3, Focus Area 4 – High-Level Costing.

[3] Chouinard, P. and Wood, I.D.H. (2007). The Department of National Defence Strategic Cost Model: Development. Scientific Report, DRDC CORA TR 2007-14, Defence Research and Development Canada.

[4] Solomon, B., Chouinard, P., and Kerzner, L. (2008). The Department of National Defence Strategic Cost Model: Volume II - Theory and Empirics. Scientific Report, DRDC CORA TR 2008-03, Defence Research and Development Canada.

[5] MacPherson, R. (2013). The Strategic Cost Model – 2012. Scientific Report, DRDC CORA CR 2013-003, Defence Research and Development Canada.

[6] Sokri, A. (2015). National Assignments – Canada's Input. TTCP JSA TP-3, Focus Area 4 – High-Level Costing.

[7] Gardner, M. ADM(Fin) D Cost S (25 June 2015, 08:10 AM). Strategic Cost Model (SCM).

[8] Tanzania, A., Milosevic, I., and Musker, B. (2015). National Assignments – New Zealand's Input. TTCP JSA TP-3, Focus Area 4 – High-Level Costing.

[9] Weir, T. and Johns, K. (2015). National Assignments – Australia's Input. TTCP JSA TP-3, Focus Area 4 – High-Level Costing.

[10] Esler, S.V. and Nye, A. (2015). National Assignments – UK's Input. TTCP JSA TP-3, Focus Area 4 – High-Level Costing.

[11] Sokri, A. and Ghanmi, A. (2015). Cost Risk Analysis Methods for Defence Acquisition Projects. International Conference on Risk Analysis, Barcelona, Spain, May 26–29.

[12] Suebvisai, P. (2013). Parametric Cost Estimation Model For Microchannel Bonding Process Based On Activity Based Costing. Ph.D. Dissertation, the University of Texas at Arlington.

[13] Gupta, M. and Galloway, K. (2003). Activity-based costing/management and its implications for operations management. Technovation, 23(2), 131–138.

[14] Cooper, R. (1988). The rise of activity-based costing—part two: when do I need an activity-based costing system? Journal of Cost Management, Summer, 45–53.

[15] Cooper, R. and Kaplan, R.S. (1988). Measure costs right: make the right decisions. Harvard Business Review 66, 96–103.

[16] Eggers, J.L. and Bangert, C.E. (1998). Activity-based costing. American Water Works Association. Journal, 90(6), 63.

[17] Tsai, W.H. (1996). Activity-based costing model for joint products. Computers & Industrial Engineering, 31(3–4), 725–729.

[18] Kaplan, R.S. (2006). The competitive advantage of management accounting. Journal of management accounting research, 18(1), 127–135.

[19] Egbunike, A.P., Egbunike, C.F., and Mofolusho, M.O. (2013). Activity Based Costing System and Nigeria's March towards VISION 20: 2020. International Business Research, 6(11), 168.

[20] Celikkol, S. (2007). Cost driver selection in activity-based costing systems. Masters Dissertation, the University of Arkansas.

[21] Chivukula, S. (2011). Estimating product assembly cost using an activity-based costing approach. Masters Dissertation, the State University of New York at Binghamton.

[22] Bula, J.M. (2004). Activity-based costing and performance measurement: A strategic integration approach. Masters Dissertation, the California State University.

[23] Cooper, R. and Slagmulder, R. (1998). What is strategic cost management? Strategic Finance, 79(7), 14.

[24] Cokins, G. (1997). If activity based costing is the answer, what is the question? IIE Solutions, 29(8), 38–43.

[25] Panita, S. (2013). Parametric Cost Estimation Model for Microchannel Bonding Process Based On Activity Based Costing. Ph.D. Dissertation, the University of Texas at Arlington.

[26] Qian, L. and Ben-Arieh, D. (2008). Parametric cost estimation based on activity-based costing: A case study for design and development of rotational parts. International Journal of Production Economics, 113(2), 805–818.

[27] Bromwich, M. and Hong, C. (1999). Activity-based costing systems and incremental costs. Management accounting research, 10(1), 39–60.

[28] Malmi, T. (1997). Towards explaining activity-based costing failure: accounting and control in a decentralized organization. Management accounting research, 8(4), 459–480.

[29] Stratton, W.O., Desroches, D., Lawson, R.A., and Hatch, T. (2009). Activity-based costing: Is it still relevant? Management accounting quarterly, 10(3), 31.

[30] Kaplan, R.S. and Anderson, S. (2004, November). Time-driven activity-based costing. Harvard Business Review, 82(11), 131–138.

[31] Innes, J., Mitchell, F., and Sinclair, D. (2000). Activity-based costing in the UK's largest companies: A comparison of 1994 and 1995 results. Management Accounting Research, 11, 349–362.

[32] Gonzalez, M. (2014). Time-driven activity-based costing for healthcare provider supply chain processes. Masters Dissertation, the University of Arkansas.

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Annex A Survey Questions

Below is a list of survey questions prepared by Young [2]. These questions were intended to be answered for each national high-level costing model.

A.1 Utility

1. [Utility—Why?]—For what purpose has the model been developed? What kinds of questions is it expected to answer?, What impact has it had? e.g., Are there any particular decisions of strategic note that it has influenced, Are there any specific initiatives where it has had an influence on the outcome?

2. [Utility—What?]—What Decisions, Business Processes, Initiatives, etc., has it enabled (or does it routinely enable)?

3. [Who?]—Who does it support (i.e., what customers, clients, organizations, governance bodies, …), Who developed & maintains the model?, Who is responsible for the accuracy of the data in the model?, Who uses the model to provide support to clients?

A.2 Methodology

1. [Principles]—Are there any general or specific principles that were specifically identified and used to guide development and/or use of the model/approach? (Note: Here we define "principle" as an idea or concept that serves to guide thought and action).

2. [Methodology—Costing Approach?]—How would you best describe or classify the costing approach that underpins the model?

3. [Methodology—Main Cost Objects?]—What are the main cost objects and/or main cost object groupings (i.e., final cost objects, intermediate cost objects, initial cost objects)? This question is important in order that we can understand what exactly is being costed and how costs are traced within each model … a diagram may be the best method by which to convey the response to this question. Please add an annex to further elaborate the answer to this question.

4. [Methodology—Inputs & Cost Base?]—What are the model inputs?, What is the cost base?

5. [Methodology—Data Sources?]—Where do model inputs come from? What is the source? (e.g., transactional systems, synthesized data, subject matter experts).

6. [Methodology—Outputs?]—What are the main outputs from the model? (e.g., financial profiles, resource profiles).

7. [Methodology—Visualisations?]—List and briefly describe the main visualizations used to succinctly characterize model results? Does the model directly support visualisation? i.e., are visualizations produced directly by the model or are they developed separately?

8. [Methodology—Granularity?]—How would you best describe the granularity and degree of fidelity of the model?

9. [Methodology—Analytical Aspects?]—Are there specific aspects of the analytical approach of note? How are costs traced? How are costs projected? What kinds of cost drivers are considered?

A.3 Implementation

1. [Implementation—Software Tools?]—What software tools have been used to implement the model? What software is used to store and manipulate input, output and intermediate data? What software is used for computational/analytical aspects? What software is used to produce visualizations?

2. [Implementation—Timescale?]—What timescale(s) does the model encapsulate?

A.4 Limitations

1. [Limitations—Exclusions?]—What does the model specifically exclude? Are there aspects that are purposely outside of the scope of the model?

2. [Limitations—Deficiencies?]—Are there known deficiencies or areas where improvements to the model could be beneficial (considering its overall purpose)? Are there any caveats that are often quoted when presenting the model or results from the model? Note: this information could be useful when developing of our costing framework and for steering the group's future efforts.

List of Symbols/Abbreviations/Acronyms/Initialisms

ABC	Activity-Based Costing
ADM (Fin)	Assistant Deputy Minister Finance
CAF	The Canadian Armed Forces
CCD	The Centre for Costing in Defence
CFD	Chief of Force Development
CIT	Capital Integration Tool
CORA	Centre for Operational Research and Analysis
DCP	Defence Capability Plan
DND	The Department of National National Defence
DPM	DND Personnel and O&M Model
DRDC	Defence Research and Development Canada
FA	Focus Area
FMAS	DND Financial and Managerial Accounting System
FSCM	Force Structure Cost Model
JSA	Joint Systems and Analysis
NP	National Procurement
NZ	New Zealand
O&M	Operating and Maintenance
PBIMA	Preparedness Business Intelligence and Management Audit
PRICIE	**P**ersonnel; **R**esearch and Development (R&D); **I**nfrastructure and Organization; **C**oncepts, Doctrine, and Collective Training; **I**nformation Systems; and **E**quipment, Supplies and Services
R&D	Research and Development
SCM	Strategic Cost Model
SPORT	The Strategic Planning Operational Research Team
TP3	Technical Panel
TTCP	The Technical Cooperation Program
UK	United Kingdom
VCDS	Vice Chief of the Defence Staff

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DOCUMENT CONTROL DATA

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1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g., Centre sponsoring a contractor's report, or tasking agency, are entered in Section 8.)

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Defence Research and Development Canada
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Ottawa, Ontario K1A 0K2
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2a. SECURITY MARKING (Overall security marking of the document including special supplemental markings if applicable.)

UNCLASSIFIED

2b. CONTROLLED GOODS

(NON-CONTROLLED GOODS)
DMC A

3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.)

High-Level Costing Models within the Technical Cooperation Program Nations

4. AUTHORS (last name, followed by initials – ranks, titles, etc., not to be used)

Sokri, A.

5. DATE OF PUBLICATION (Month and year of publication of document.)	6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.)	6b. NO. OF REFS (Total cited in document.)
June 2017	32	32

7. DESCRIPTIVE NOTES (The category of the document, e.g., technical report, technical note or memorandum. If appropriate, enter the type of report, e.g., interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)

Reference Document

8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.)

DRDC – Centre for Operational Research and Analysis
Defence Research and Development Canada
101 Colonel By Drive
Ottawa, Ontario 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.)	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)
00bh	

10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.)	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.)
DRDC-RDDC-2017-D058	

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This Reference Document captures the work completed by the author under the Technical Cooperation Program (TTCP) Joint Systems and Analysis (JSA) Group umbrella prior to its cancellation. It is an incomplete work that was initially intended to deeply compare different high-level costing models and suggest a new strategic costing framework for the TTCP nations. As a result it is limited to providing a preliminary comparison of four different high-level costing models from four TTCP nations. It also describes the foundation of an approach to high-level costing which could be used in the new framework.

Ce document de référence contient le travail réalisé par l'auteur dans le cadre du groupe d'Analyse des systèmes communs du Programme de coopération technique (PCT) avant sa dissolution. Il s'agit d'un travail inachevé qui avait pour but à l'origine de comparer en profondeur divers modèles de prévision des coûts stratégiques et de proposer un nouveau cadre en la matière. Ce document ne présente, de ce fait, qu'une comparaison préliminaire de quatre modèles de coûts issus des pays du PCT. On y trouve également une description de certains principes de base pouvant servir à l'élaboration d'un nouveau cadre de prévision des coûts stratégiques.

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The Technical Cooperation Program (TTC); High-level costing models; Activity-Based Costing (ABC)