Modelling Defence Enterprise Value: Showing how the institution makes Defence possible

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Abstract

Sound strategic defence decisions come from an integrated and holistic understanding of the state of the defence enterprise and the expected trajectory of that state over time associated with decision alternatives. The enormous diversity of interests and cultures, military and civilian, within Defence makes attaining such an understanding very challenging. Once attained, clearly conveying that understanding to senior officials outside of Defence poses an additional challenge, on the success of which hangs expenditure authority over 100's of millions of dollars. A framework that brings clarity to the construction and communication of such an understanding can eliminate much of this difficulty. This paper presents an approach focussed on defence outcomes that models the life cycles of enabling forms of capital to provide a lens on how the Defence institution makes Defence possible. Examples are offered illustrating its use to design senior executive dashboards and show capital investment impact in a way that leads to better strategic narratives and conversations with government.

Author Information

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1. Introduction

This paper documents a set of ideas that have emerged from the work done within the Strategic Planning Operational Research Team (SPORT) to help Canada's Department of National Defence (DND) usefully reframe its strategic decisions. One of the most challenging tasks has been informing trade-off decisions between major capital investments toward development of a balanced and affordable capital investment portfolio. The intention of the work here is to develop an approach to model and graphically represent the dynamics of enterprise value creation and management, in all its forms, as a lens and analysis framework to inform strategic decision making, including capital value injection into Defence.

The term "Defence" is used here, at least initially, to refer to the DND and the Canadian Armed Forces (CAF), which will also sometimes be conveyed with the term "Defence enterprise". However, it is also used later on to refer more generically to national ministries of defence including their military forces.

To simplify references to senior Defence executives, we will refer to them in levels. In Defence, Level Zero (L0) is the most senior unelected level of authority, shared by the Deputy Minister, Defence's most senior civil servant, and the Chief of the Defence Staff, the senior military officer, holding a "four star" rank. Answering to these are the heads of the functional organisations and military commands within Defence, said to exercise Level One (L1) authority.

We begin in Section 2 by describing the problem that introduced us to this field of work, and briefly describe the results of that work, setting the stage for the larger problem. In Section 3, we seek to leverage recent work articulating the Canadian Defence program in terms capital life cycles to develop a networked value model. In Section 4, we offer and illustrate uses of a networked value model to aid internal strategic management and external communication with government. Section 5 infers a logical procedure for developing a networked value model and discusses practical issues in its use. Section 6 concludes the paper with future work and final thoughts.

2. The Capital Investment Problem

In 2013, the central agency overseeing Canada's public service directed that DND reformulate the list of major capital investments (capital projects exceeding $5,000,000 in acquisition costs) that they would begin expending funds on during the next 20 years. In response, the Vice-Chief of the Defence Staff (VCDS) and the Chief Financial Officer (CFO) for DND directed the Chief of Force Development[1] (CFD) to initiate the Capital Investment Program Plan Review (CIPPR) (1).[2]

[1] The Chief of Force Development sits under the VCDS, who is regarded as the most senior of the L1's.
[2] The CIPPR initiative had a mandate from the VCDS and the CFO "to undertake a rationalization of all investments at the Identification … and Option Analysis … stages before fall 2014. The aim is to produce a DND/CAF consolidated balanced portfolio consisting of critical, viable and affordable capabilities representing best value for money as well as institutionalizing a process that will be transparent, repeatable, rigorous and coherent against which all present and future investments will be assessed."

2.1 The approach

On advice from Defence Research & Development Canada's Centre for Operational Research & Analysis (DRDC CORA), CFD adopted a portfolio optimisation paradigm in which an objective function (a project value scoring scheme) estimates the relative utility promised by the deliverables of each alternative investment and software searches combinations of investments for the combination promising to deliver the greatest total value within constraints on available unallocated year-over-year funding and project execution capacity.

2.2 Value modelling

The initial CIPPR objective function fully satisfied the two most important criteria:

1. It had to provide numerical estimates of relative investment deliverable value (utility or benefit completely independent of cost) in a way that was intuitively reasonable both to the L1's (and their delegates) overseeing the process and those sponsoring the capital projects evaluated, and
2. It had to be realized quickly, requiring only data that was readily available.

A Multi-Criterion Decision Analysis (MCDA) approach to value modelling was taken, in which is computed a weighted sum of three quantities that could reasonably be expected to correlate with project value. These quantities reflected three different value perspectives: from above Defence (government policy and legislation), at the top of Defence (L0-sanctioned analyses and directives) and within Defence according to project sponsoring L1s. Score components from each of these perspectives (see Annex A for more detailed descriptions) were normalized to the [0,1] interval and combined using weights summing to one set by leadership within CFD, resulting in objective function values on the same interval.

2.3 Developed software

Over a seven month period, two operational research (OR) scientists designed and coded software using Gnu Math Programming Language and Gnu Linear Programming Kit routines for the optimization, R and available statistical subroutines to drive the visualizations, JavaScript calls to out-sourced D3 visualizations, and HTML for a user-friendly interface. The result of their combined effort was VIPOR (Visual Investment Plan Optimization and Revision) (2) (3).

With the value model being very approximate, the numerically optimal combination of investments was almost certainly not the best portfolio. Users would need to review and amend the results to remove over-valued and insert undervalued investments. Therefore, the software incorporated drag-and-drop portfolio modification and enabled re-optimization, treating these changes as new constraints. The mixed integer optimization routine was generally able to find a combination from the pool of more than 300 candidate investments that came within 5% of the theoretical maximum portfolio value[3] in about 45 seconds of processing.

The software provided a variety of illuminating visualizations, including:

- Investment option bubbles sized by either cost or value, segregated by their portfolio status and grouped by L1 sponsor, execution timeframe or both;

[3] The theoretical maximum from the relaxed solution is computed quickly by allowing partial funding of projects delivering partial value.

- Pop-ups summarizing any project of interest;
- Year-over-year financial demand, supply and portfolio usage;
- Aggregated year-over-year project execution capacity requirements using a fiscal proxy[4];
- A parallel coordinates view for identifying and comparing groups of projects with portfolio-relevant attributes; and
- A history of how a portfolio has evolved over modification – re-optimization cycles.

2.4 Success factors

The software-supported process results were very well received in senior briefings, and significantly improved DND investment planning credibility with central agencies, while generating interest from other federal departments and allied nations. This success can be traced largely to two interacting aspects. Convenient portfolio modification with intuitive visualization brought quick realizations that expensive projects spending in the same years can exceed available funding in those years rendering a portfolio infeasible. In effect, the software provided a very efficient environment for discovering the opportunity-cost of major investment options.

It was recognized early on that modelling value to correctly anticipate fully-informed executive trade-off decisions was notoriously difficult, even with full access to executive thinking, careful calibration and objective data sources. The initial CIPPR value model was developed without direct access to Defence seniors and under tight time and staffing constraints.

The client was warned of these limitations at the beginning. The impact was mitigated during data collection by asking project sponsors to flag investments they deemed to be "must-haves." This primed the opportunity cost discovery process and led quickly to the shocking discovery that even the "must-haves" exceeded available funding. This triggered the most critically needed conversations with sponsors, immediately commencing the strong ongoing return on the software development investment. The result of these interactions was thorough preparation for Defence negotiations with government during the Defence Policy Review that culminated in Canada's new "Strong, Secure, Engaged" defence policy in 2017 with augmented capital funding.

2.5 Weaknesses

The first sign of weak value modelling was seen in the initially constructed portfolios. To borrow from the parable that a jar full of rocks has room for pebbles and then for sand, the initial portfolios were full of sand, consisting almost entirely of low cost projects. All large projects had to be dragged in and the portfolio re-optimized around them. A brief look at objective function values revealed a most-to-least valuable ratio of about 20, while the most-to-least expensive ratio was about 500 or 25 times that value. With modelled value more cheaply acquired than actual value, the model exhibited a systematic cost bias.

Ideally, if multiple dimensions of value were to be recognized, they should be mutually orthogonal. This was clearly not the case with CIPPR. There were strong correlations between all three value dimensions, suggesting double counting of value. Noted exceptions to this correlation (new military hospitals and certain highly classified projects) did not enjoy the same benefit, creating systematic political bias.

[4] Some projects qualify for government funding that amortizes cost over the life of the asset. Such projects impose execution burdens distributed over time differently than their costs to defence.

It has also been noted that there is something false about summing the MCDA value components in a portfolio optimization paradigm. Multiple different projects may deliver specific systems that are filling similar roles. The seventh such project added to the portfolio is not necessarily adding as much value as it would have if it had been the only such project. The incremental value of a project depends upon what the portfolio already contains. Thus, the portfolio value perspective is different from the project value perspective. Implied in this is the idea that the criteria for an optimal portfolio are different from the criteria of a valuable project. The larger requirements picture is more fitly applied at the portfolio level than at the project level.

The stronger of the two capability-based value models was 2.a, the military one. (See Annex A.) It referenced the considerable deliberation and detailed data collection of analysis supporting Defence force development. It also considered the relative importance of specific capabilities in planning scenarios and the range of capabilities addressed by a single investment. The raw[5] military capability scores also generated a very wide greatest-to-least value ratio, offering excellent discrimination, producing a value distribution that resembled the distribution of project costs. That said, the taxonomy of military capabilities used in Defence force development is not truly founded on operational effects. To illustrate, though their persistence, responsiveness and logistic implications are clearly different, there is no account taken in Canadian military capability taxonomy of the clear overlap and intrinsic interchangeability of the effects created by field artillery, naval gunfire and aerial bombardment. Portfolio trade-offs need to be informed by even partial equivalences between effects and their delivery mechanism alternatives.

The institutional capability value model (2.b) was based on more subjective evidence and referred to an un-prioritized initiative list. This contrasted with the careful prioritization of military capability gaps found in force development analysis judgements referenced in military capability project valuation. Necessity required more imaginative use of weaker references created more for upward reporting than internal direction. The greatest-to-least institutional capability value ratio was closer to 15. Even more problematic was the relatively uniform distribution of raw institutional capability scores across the interval, giving them a clear advantage over raw military capability scores. This had to be corrected by transforming both into quantiles, where the transformed score reflected the proportion of other raw scores less than the project's own raw score. This imposed relatively uniform score distributions (at the cost of all the nuance in the military raw scores) and embedded the reasonable assertion that the raw military and institutional scoring schemes were only valid for prioritizing within their respective project types.

Beyond this, it seemed that the way in which Defence mandate success depends upon the functions of Defence was under-articulated and not properly integrated into the value picture. The line between military and institutional capability is, in an important sense, arbitrary. The vast majority of Defence institutional action contemplates sending forces into harm's way. While the compelling dynamics of military operations highlight the role of military training, training depends upon more pedestrian things like facility availability, equipment maintenance and domestic logistics, and these depend upon still more mundane institutional dynamics. The further away from the "pointy end" of the military art that phenomena appear, the less military interest and systematic focus they tend to receive. This pushes the institutional capability picture to the periphery of the investment planning dialogue. There is clearly much more to be done to appropriately characterize institutional investment utility.

[5] The next paragraph explains the transformed score.

3. A networked value model of Defence

So, how can the Defence institution be integrated into the Defence-wide strategic resource allocation dialogue with military operational capability requirements?

A holistic picture of Defence is needed, one expressed in terms that support numerical value model development and that foster a holistic and organic capital investment conversation. Recent work has been done in Canada to model Defence value and bring clearer expression to the intrinsic dependencies of Defence on the institution, resulting in a formally articulated and endorsed Defence program structure. However, the utility of the structure has not been widely understood and therefore not fully exploited within Defence. Where its utility was understood, there was also some reluctance to perturb the balance of power between L1 authorities. We believe Defence (at least in Canada) needs its own "1,000 word picture" showing the things that are truly common across the Defence team, exposing the fundamental inter-dependence that accentuates the connectedness between each part of the whole, offering to all a big picture of the dynamics of defence utility, providing a context for strategically-significant innovation to be fully leveraged for national benefit.

To clarify terms, the usage of "modelling" in the title is not (at least initially) the numerical quantification required for portfolio optimization, but rather a more generic use of the term to mean "abstraction that generates empowering insight". The intention is to pull out from among the diversity of Defence phenomena, subcultures and interests a picture that brings a distinctly useful type of clarity to conversations on topics of value, utility and benefit.

Section 3.1 introduces the 2014 Program Alignment Architecture (PAA) for Defence based upon (4), and notes some relevant features desirable in an enduring model of Defence value. Section 3.2 portrays the Sub-Programs (SPs) of the PAA juxtaposed to show the creation, transformation and flow of value toward the fulfilment of the Defence mandate. Section 3.3 uses a state diagram approach to depict the Sub-Sub-Programs (SSPs) that make up the life cycle of capability components, the combined result of which we offer as a prototype of a networked value model.

3.1 Canada's Program Alignment Architecture for Defence

Beginning in 2003, Federal policy (5) required every federal department to have a PAA that will serve as structure for reporting to Parliament and to Canadians what it does with money from Canadian taxpayers to fulfil its mandate from the Government of Canada, and for bringing coherence to strategic reviews conducted to inform government-level resource reallocation decisions. The whole point of having a PAA was really two things:

1. Creating a coherent public narrative for what a department does to fulfil its mandate, and

2. Capturing the accountable linkage between resources consumed and results obtained so that government can optimize their total return on investment.

Two previous versions of the PAA for National Defence, in 2006 and again in 2009, were not well received by the central agency overseeing federal departments. When the 2009 PAA was used as the structure for a strategic review of Defence, one of the specific purposes for every PAA, its poor fitness for purpose led to reformulation in order to better:

1. Reflect the enduring tasks of Defence in a comprehensive, non-overlapping way;
2. Enable the explicit identification of program dependencies;

3. Provide a foundation for performance management; and
4. Support strategic review and resource reallocation between of Federal programs.

The result (shown in Table 1 down to the sub-program level) was a complete redesign providing a taxonomy of everything Defence does to fulfil its mandate. In 2014, it was promulgated as the structure for all annual reporting to Parliament of Defence plans for the coming year and results from the previous year. A detailed description of the 2014 Defence PAA is given in Annex B.

Table 1: *The 2014 PAA for Defence down to the Sub-Program level* (4)

Strategic Objective	Program	Program title
I. Defence Operations & Services Improve Stability & Security, & Promote Canadian Interests & Values	**1.0**	**Defence Combat & Support Operations**
	1.1	Domestic & Continental Defence Operations
	1.2	International Combat Operations
	1.3	Ongoing Centralized Operations & Operational Enablement
	2.0	**Defence Services & Contributions to Government**
	2.1	Disaster Relief & Humanitarian Operations
	2.2	Defence Services for Canadian Safety & Security
	2.3	Military Heritage & Outreach
II. Defence Remains Continually Prepared to Deliver National Defence & Defence Services in Alignment with Canadian Interests & Values	**3.0**	**Defence Ready Force Element Production**
	3.1	Force Elements Readiness Sustainment
	3.2	Force Elements Integration Training
	3.3	Force Elements Production
	3.4	Operational Readiness Production, Coordination & C2
	4.0	**Defence Capability Element Production**
	4.1	Military Personnel & Organization Lifecycle
	4.2	Materiel Lifecycle
	4.3	Real Property Lifecycle
	4.4	Information Systems Lifecycle
	5.0	**Defence Capability Development & Research**
	5.1	Capability Design, Development & Integration
	5.2	Strategic Direction & Planning Support
	6.0	**Internal Services**
	6.1	Management & Oversight
	6.2	Communications
	6.3	Legal Services
	6.4	Human Resources Management
	6.5	Financial Management
	6.6	Information Management
	6.7	Information Technology
	6.8	Real Property
	6.9	Material
	6.10	Acquisition

3.1.1 Design of the 2014 Defence PAA

Program 1 can be thought of as military operations with guns. SP 1.1 includes defence of Canada, presence patrols, participation in the North American Air Defence Command (NORAD) and regional operations with US forces. SP1.2 includes both short and long term international conflict operations as well as standing NATO commitments. SP1.3 includes command and control of all operations, intelligence operations, logistics, military diplomacy and global engagement.

Program 2 can be thought of as Defence operations other than military operations with guns. These are the other outward-facing program elements of Defence. SP 2.1 provides help against hazards domestic, regional or global and also includes non-combatant evacuation operations. SP 2.2 includes planning against and dealing with terrorism, security augmentation at major Canadian events, search and rescue and services to other government departments including R&D in support of Public Safety. SP 2.3 includes military libraries, museums, military demonstrations and youth cadet programs. Together, Programs 1 and 2 span the full array of Defence activity to improve stability and security, and to promote Canadian Interests and values.

Program 3 is where ready force elements come from. These may be thought of as the smallest deployable units of capability, often defined in terms of platforms (eg. a ship, a tank, two fighter aircraft) or some sub-unit level element of land forces. They become force elements in SP 3.3 where the appropriate military personnel are brought together with the necessary equipment, real property and networks to acquire the requisite skills. Then, in SP3.2, they learn to work collaboratively with other force elements at increasing levels of aggregation until they reach the requisite readiness level. Skill sets being perishable, SP 3.1 becomes necessary to ensure what they sustain readiness in capabilities they do not have opportunity to fully use until the end of their high-readiness obligations. SP 3.4 oversees force element production, coordinating everything needed to satisfy force posture and readiness standards. Clearly, the conduct of each of these SPs looks very different for naval, land, air, special and joint and common force elements. These differences are recognized and accommodated at the SSP level in all four SPs.

Everything in Program 3 is possible only because there exist pools of personnel, equipment, real property and information networks managed in their respective SPs in Program 4 for their availability to satisfy the needs of force element production. Each of these four resource pools has its own life cycle processes in which the numbers and conditions of assets are monitored against force element (and other institutional) requirements and plans are formulated for them to be acquired, made ready for service, upgraded as necessary, restored as time and usage degrade their condition, and ultimately disposed of at end of useful life. All these processes and the requirements they must satisfy are overseen and adjusted, with performance, risk and stakeholder expectations managed and administered for the long term in each of the Program 4.0 SPs.

The SSPs of SP 4.1 Military Personnel & Organization Lifecycle illustrates the life cycle process breakdown in Program 4 elements, providing the most elaborated break-out of the program:

4.1.1 Military Personnel - Regular Force Portfolio Management
4.1.2 Military Personnel - Reserve Force Portfolio Management
4.1.3 Military Personnel - Recruitment
4.1.4 Military Personnel - Transition & Release
4.1.5 Military Personnel - Professional Development Training

4.1.6 Military Personnel - Occupation Training
4.1.7 Military Personnel - Morale & Well Being
4.1.8 Military Personnel - Health Care
4.1.9 Organization - Security, Protection, Justice & Safety
4.1.10 Military Personnel & Organization - Strategic Coordination, Development & Control

Everything taking place in Programs 3 and 4 is done to fulfil near- and long-term defence plans developed and prioritized in Program 5. SP 5.1 is where possible capability futures are conceived, designed and planned to satisfy the anticipated needs of the changing security environment. It is also where concept and doctrine development along with warfare experimentation occur to validate future capability plans, and also where science and technology expertise needed to support capability evolution are brought to bear on capability challenges. The two main products of SP 5.2 are the prioritized long-term capability plans to be delivered by capital investment (and other resource pool adjustments) and force posture and readiness standards to regulate force production for the near term. Program 5 products effectively set or imply targets for Programs 4 and 3.

The way in which Internal Services Program 6 are defined and partitioned into SPs was specified by the central agency setting requirements for PAAs. Imposing such a structure enabled consistent aggregation of statistics on what the central agency deems to be common forms of overhead across all federal departments. However, some of the activities that might naturally be implied by the naming of SPs in Program 6 have been specifically cut away for explicit inclusion in the first five Defence-specific programs. Specific examples include the following:

- SP 6.4 Human Resources Management does not include military HR (SP 4.1),
- SP 6.6 Information Management which does not include the military intelligence function, a military capability,
- SP 6.7 Information Technology does not include military IT (SP 4.4),
- SP 6.8 Real Property excludes military and Defence-specific real property (SP 4.3), and
- SP 6.9 Material excludes military equipment (SP 4.2).

Without these adjustments, Defence is made to appear as though it is almost entirely internal services, quite misrepresenting its true character, and undermining the utility and intention of the Internal Services construct. Further detail on the PAA is available in Annex B.

Standing back from the whole structure, Programs 1 and 2 fulfilling Strategic Objective I are possible only because what we call the Defence institution does everything necessary to produce forces that are able and ready to conduct the operations these programs entail. This is the essence of the second strategic objective: Defence Remains Continually Prepared to Deliver Defence & Defence Services …. Clearly, actions fulfilling Strategic Objective 1 depend on having already successfully achieved necessary parts of Strategic Objective 2. In this respect, Programs 3 through 5 are "provider programs", inward facing programs that set up the success of those facing outwards, in this case, critical enablers to Programs 1 and 2. However, they also directly support the Defence mandate by providing the Prime Minister and cabinet with a menu of substantial strategic military alternatives from which to choose Canada's response to domestic, regional and global concerns. This also generates military deterrence to those who would threaten Canadian strategic interests at home and abroad. Finally, Program 6 addresses a wide variety of administrative needs of each of the other Programs.

3.1.2 Value-relevant features of the 2014 Defence PAA

Our intention here is to find appropriate terms on which to model value within Defence. Some find the word value suggestive of monetary terms, but this is a distraction clarified by Warren Buffet's maxim (6): "Price is what you pay; value is what you get." What Defence gets from the money it spends takes many different forms, so we need to discuss the concept of capital. We have already used the term to refer to investments delivering equipment and real property of enduring value to defence. According to one Oxford definition, capital "a valuable resource of a particular kind" (7). Here, the term is used to mean anything of enduring value to Defence, *i.e.* as opposed to consumable commodities. One can think of forms of capital as carriers of value. That value fluctuates with their condition, which can be improved at some cost. Therefore, the dynamics of value creation and management in Defence are made explicit in the flow of assets into and out of Defence, being degraded, restored and improved along the way until end-of-useful-life.

In this context, the 2014 PAA for Defence models value in the following ways.

1. By explicitly incorporating dependencies into the structure of the PAA, it is clearly shown that value flows
    a. from Program 3 (ready force elements) to Programs 1 and 2 (Defence services);
    b. from Program 4 (elements of capability) to Program 3 (ready force elements);
    c. from Program 5 (designed whole-of-force) to Programs 3 and 4 (realized design); and
    d. from Program 6 (enabling services) to Programs 1 through 5 (defence mandate fulfilment).

2. What we call the institutional Defence programs (3.0 – 5.0) are each defined around specific types of capital value.
    a. Program 3.0 is about life cycling force elements, arguably the most outcome-relevant form of capital in Defence;

    b. Program 4.0 is defined around the life cycles of specific forms of capital input to military capability:
        i. Military personnel (SP 4.1),
        ii. Military equipment (SP 4.2),
        iii. Defence real property (SP4.3), and
        iv. Information systems (SP4,4).

    c. The SSP break-outs of Program 4 identify specific processes that add distinct types of value to elements within their respective portfolio.

    d. Program 5.0 is defined around the renewal of force plans.

A program structure that identifies and coherently handles the management of assets that carry value through Defence lends itself to clear graphical representation illustrating Defence value in easily explained and interpreted terms. Value graphics implied by the 2014 Defence PAA are developed in the next two sections.

3.2 Picturing Defence value transformation

Table 2 shows several examples of ordered triples[6] representing logical propositions of the form "Producing subprogram A produces capital B for consuming SP C", as implied by the text of (4). The complete set of such triples is represented in Figure 1, generated in CmapTools (8), with which all of the figures in the paper but one were created.

Table 2: *Sub-program level value statement examples[6] derived from Defence's 2014 PAA* (4)

The Producing SP ...	**... produces value as …**	**... for the Consuming SP ….**
5.1 Capability Design, Development & Integration	Future capability options	5.2 Strategic Direction & Planning Support
5.2 Strategic Direction & Planning Support	Force Posture & Readiness standards	3.4 Operational Readiness Production, Coordination & C2
		4.1 Military Personnel & Organisation Lifecycle
		4.2 Materiel Lifecycle
⋮	⋮	⋮
4.1 Military Personnel & Organisation Lifecycle	Ready military personnel	3.3 Force Elements Production
		3.4 Operational Readiness Production, Coordination & C2
⋮	⋮	⋮
4.2 Materiel Lifecycle	Ready military equipment & supplies	3.3 Force Elements Production
⋮	⋮	⋮
3.1 Force Elements Readiness Sustainment	Ready force elements	1.1 Domestic & Continental Defence Operations
		1.2 International Combat Operations
		1.3 Ongoing Centralized Operations & Operational Enablement
		2.1 Disaster Relief & Humanitarian Operations
		2.2 Defence Services for Canadian Safety & Security
⋮	⋮	⋮

In Figure 1, each outlined block represents a numbered SP and each directed link shows the direction of asset flow with the asset name on the directed link between SPs. The diagram[7] presents critical enterprise-level Defence dependencies in an uncluttered way, with colours showing the associated PAA Program numbers.

[6] Repeated elements between consecutive triples are not repeated, but stated once to save space.
[7] CmapTools enables the diagram to be exported as a list of tab-delimited text triples. Conversely, it can be created in tab-delimited form for automatic ingest followed by drag-and-drop rearrangement of the resulting concept map.

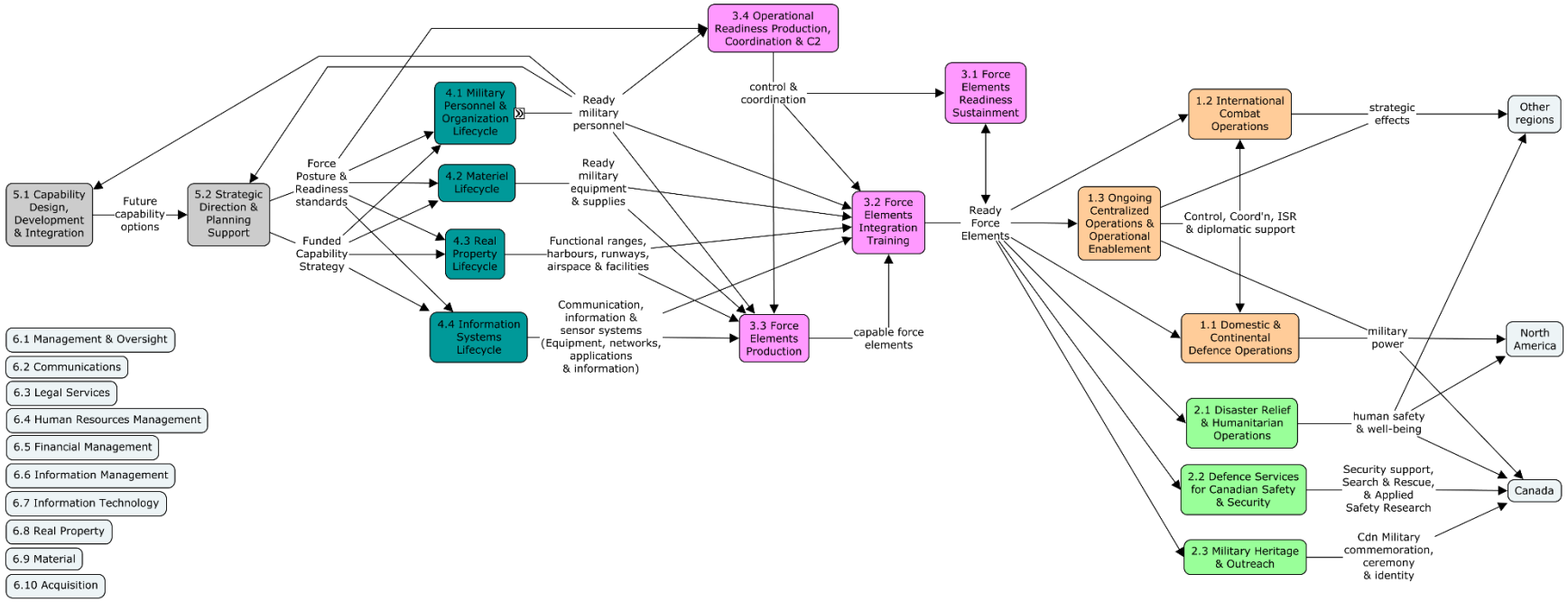

Figure 1: *A value map for Canada's Defence institution, based on the 2014 PAA at the SP level.*

From Figure 1, the use of forms of capital as defining criteria for Programs is immediately apparent; each program transforms a previous form of capital into a new form. The plans from Program 5.0 become the capability elements life cycled in Program 4.0, and these turn into force elements in Program 3. Programs 1 and 2 see force elements deliver valued Defence outcomes of various types in Canada, North America and abroad. Thus, programs transform prior value into new forms. For example, force posture and readiness standards are consumed by Program 4.0 – Defence Capability Element Production and transformed into adjusted personnel, equipment, real property and information system resource pools. The value that is added at any point continues through the diagram to the right in some form all the way to the parts of the globe receiving mission effects. To give the most fully illustrative example, the capabilities by which the CAF delivered mission effects in Afghanistan in SP 1.2 were all developed in processes contained in SP 5.1 at some previous time.

Note that the SPs of Program 6.0 – Internal Services are not connected to the other SPs. This is addressed in the next section.

3.3 Picturing value creation and management

Each of the SPs shown in Figure 1 consists of a set of more specific component SSP-level processes that produce in detail what the SP produces in general. It is possible to create all the necessary elements of a picture of value creation and management in a Program 4.0 life cycle by:

1. Identifying the triggering state of assets entering a state-triggered SSP;
2. Identifying the changed states of the assets emerging from the SSP;
3. Adding a generic process representing assets in or ready for use;
4. Identifying the processes that oversee the state-triggered processes and
5. Identifying the processes that manage life cycle process performance, risk and stakeholder relationships.

The result when applied to the life cycle of military personnel in SP 4.1 is the state diagram shown in Figure 2. The life cycle is arranged to flow from left to right. In general, upward loops constitute enhancements in the utility or value of the capital. Loops downward show how assets in reduced value states are renewed, if feasible. The same general scheme is used to illustrate the flow of capital between processes before and after SSPs have added value to them. The boundaries of Defence and the external processes (white boxes) providing and absorbing value that crosses the boundary are also shown. Figure 3 shows the SSPs of SP 4.2 in like manner.

Notice in both figures that at least two SSPs are present but not connected to the rest of SSPs. On the top left of Figure 3, the combined SSPs 4.1.1 and 4.1.2, Military Personnel – Regular and Reserve Force Portfolio Management refer to the management of military personnel for regular and reserve forces, respectively. SSP 4.1.10 oversees, evaluates, coordinates and manages requirements, stakeholder relationships, performance and risk associated with life cycle processes in 4.1. SSPs 4.2.1 and 4.2.7 in Figure 3 are the corresponding functions for materiel.

There is considerable analogy between life cycle processes pertaining to the asset types that combine to produce military capability. Each of the SPs in Program 4 draw from essentially the same processes, although they are partitioned differently in each SP, a reflection of differences in the way they are actually managed within defence.

Table 3 shows this in a summary of what is included in these SSPs according to the different asset types. The generic pattern suggested by this analogy is illustrated in Figure 4.

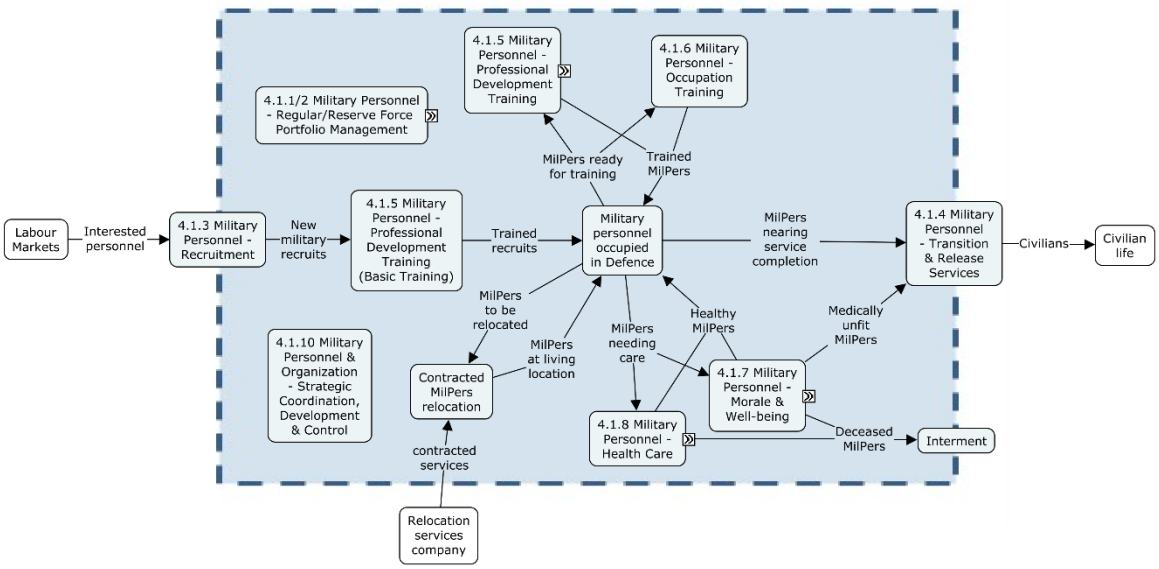

Figure 2: *A break-out of SSPs in SP 4.1 Military Personnel Lifecycle*

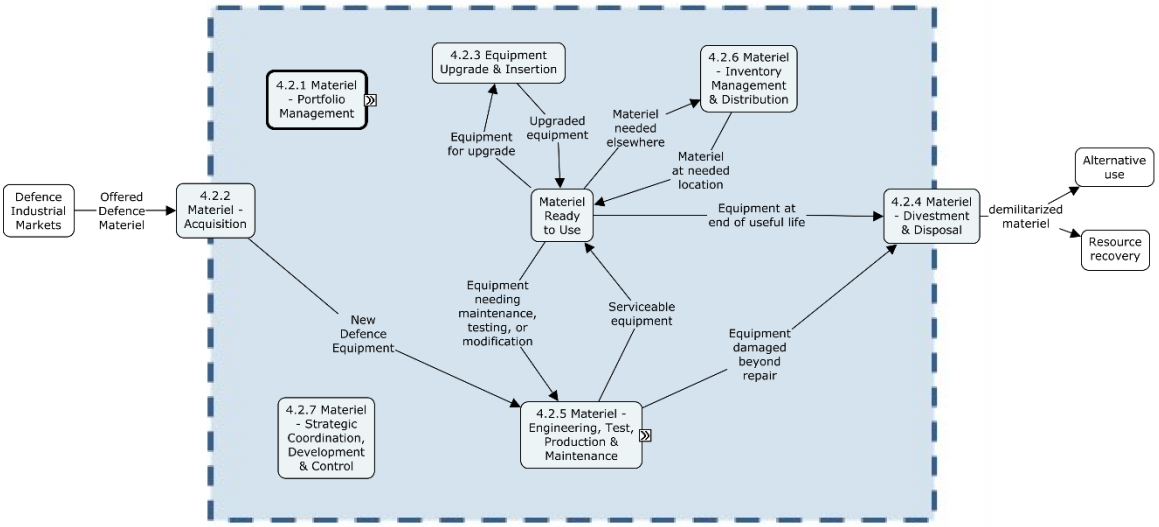

Figure 3: *A break-out of SSPs in SP 4.2 Materiel Lifecycle*

The idea of using state diagrams to illustrate value creation and management can usefully be extended beyond the confines of the principle contributions within a single SP to address a more fulsome accounting of value contributions of a single SP or SSP. For example, each of the SPs in 6.0 Internal Services has its own set of enabling relationships with each aspect of Defence operations, its own issues and its own degree of impact on Defence value creation and production. These are shown in Figure 5, which is simply Figure 1 with SP 6.4 Human Resources Management providing ready civilian employees to each of the other SPs. Though this is not immediately very useful, it becomes useful in the interplay between component processes. Intended use will dictate the degree of detail to be incorporated.

Table 3: *Capability element life cycle processes as partitioned among Program 4 SSPs* (4)

Life cycle process	Military Personnel	Military equipment	Military Real Property	Military Informatics
Portf. Manag't: Monitor portfolio conditions against requirements, plan mitigations, monitor results	4.1.1 4.1.2	4.2.1	4.3.1	4.4.1
Move elements where needed		4.2.6	X	4.4.2
Acquire new elements	4.1.3	4.2.2	4.3.2	
Upgrade existing elements	4.1.5 4.1.6	4.2.3	4.3.4	
Maintain existing elements	4.1.7 4.1.8	4.2.5		4.4.3
Protect elements from threats & hazards	4.1.9		4.3.5	
Dispose of old elements	4.1.4	4.2.4	4.3.3	
Report results, manage risk, manage stakeholder relationships, evolve process, requirements	4.1.10	4.2.7	4.3.6	4.4.4

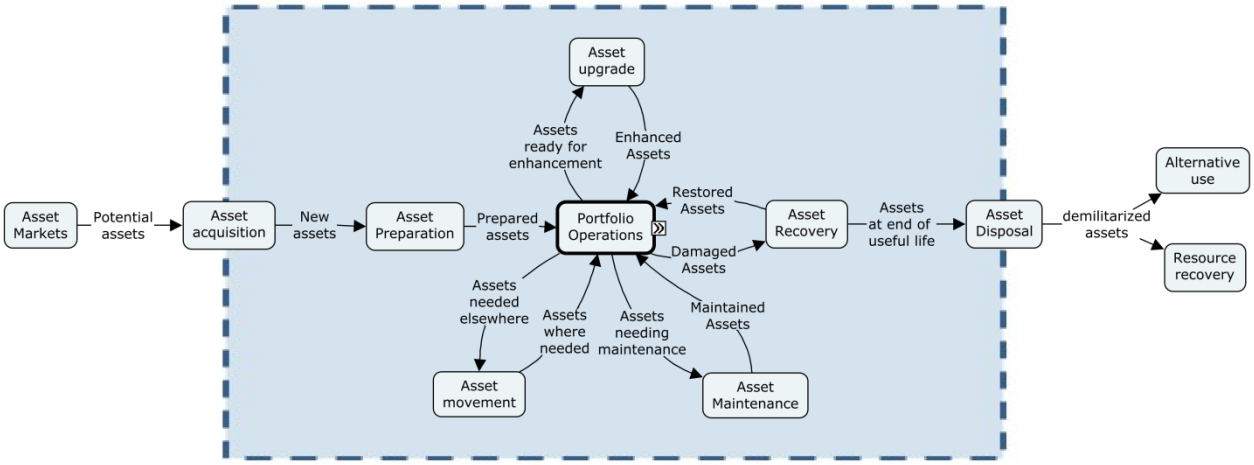

Figure 4: *A generic SSP value map tailorable to specific capital asset classes.*

A more specific extension is offered in Figure 6, which shows SSP 5.1.3 Science & Systems Development & Integration and the SSPs to which it links. More specifically, it shows two distinct aspects of activity conducted in SSP5.1.3 toward the left. The lower one concerns R&D enabling the development, acquisition and fielding of advanced capabilities, work conducted largely by the research programs of DRDC. The upper part of 5.1.3 concerns science-based decision support. This is delivered primarily by the DRDC Centre for Operational Research and Analysis. Figure 6 illustrates how SSP 5.1.3 contributes in various forms to all of the programs in the PAA, including Internal Services. In this respect, the decision support offered through operational research has much in common with Program 6 SPs, in that they enable most if not all of the Defence-specific SPs.

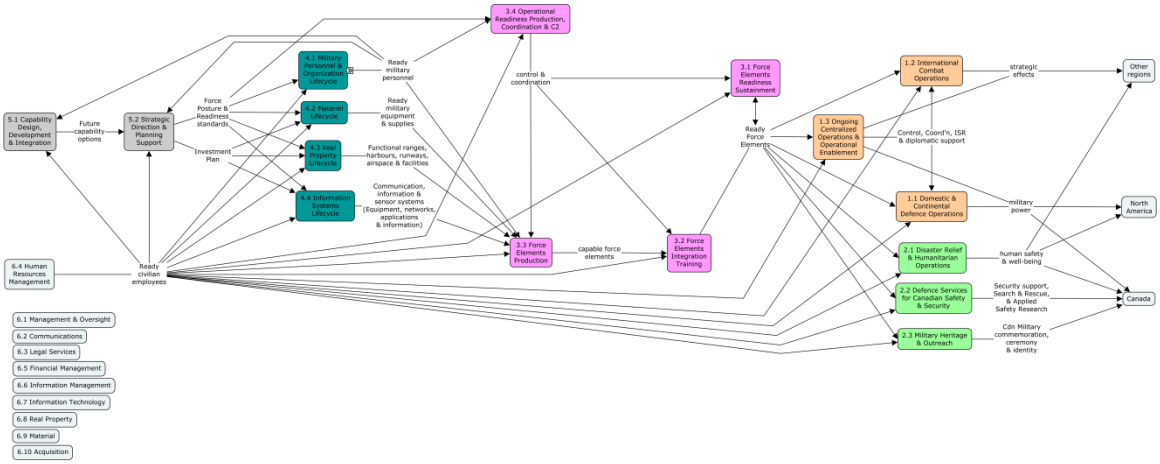

Figure 5: *The value model of Figure 1 augmented to show civilian capital value contribution*

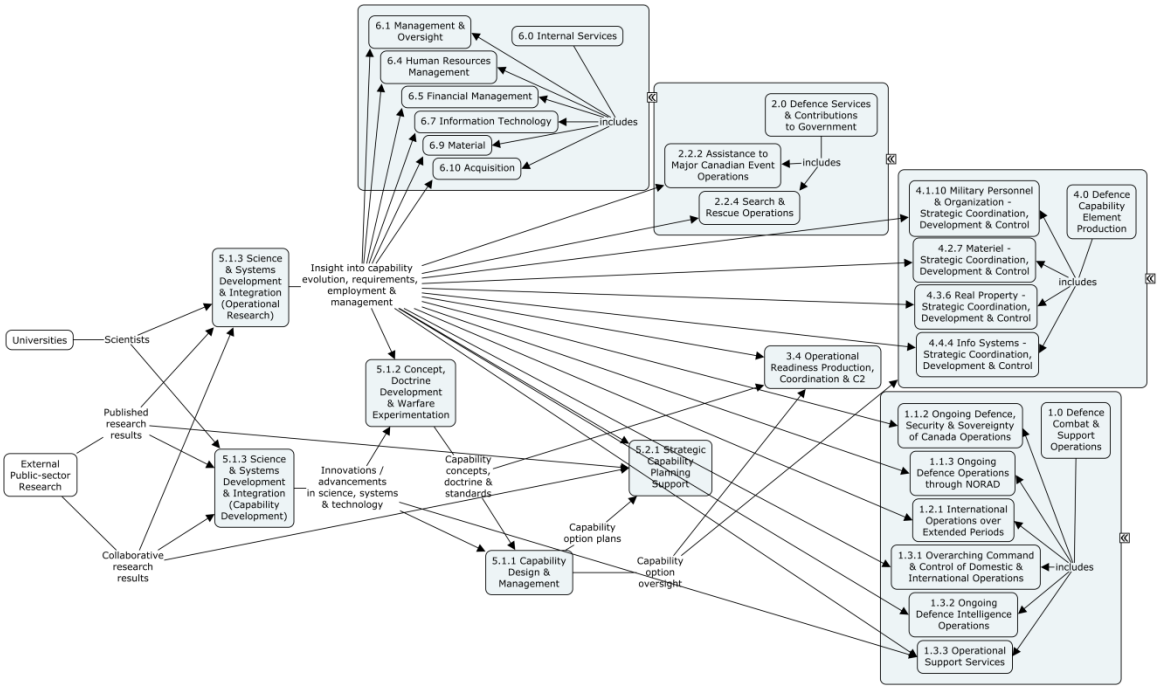

Figure 6: *SSPs linking to SSP 5.1.3 Science & Systems Development & Integration*[8]

This illustrates an important point, that value relationships are generally more complex than those implied by the tidiness of Figures 4 and 5. The approach advocated in this paper is offered primarily for use at a strategic level, though it can be exploited at a lower level with elaborations of higher granularity. If such elaborations are to be useful outside of the organizations responsible for their execution, they will need to take the enterprise-level model as their starting points. Figure 6 is an illustration of this.

[8] The variety of SSPs to which OR contributes was augmented beyond (4) from personal knowledge, though the same could not be done for DRDC capability development contributions, potentially distorting the relative breadth of contribution.

3.4 A Networked Value Model

All of the above has been stated to show that the most natural and meaningful terms in which to model value in the Defence public sector are transformations and state changes in Defence-relevant assets. We call the structure a Networked Value Model or NVM. The diagrams shown so far illustrate parts of such a structure, but the model is the totality of the structure.

To be clear, what we have shown here from the 2014 Defence PAA is presented not because it is an ideal NVM, but because it embodies useful properties for informing value management, implying a set of core attributes for a new type of model. Work in Canada and, hopefully, elsewhere will build-out and refine the idea to make it more powerful, useful and versatile. This is an early but useful abstraction of value dynamics within Defence, one example of how value creation and management for results can be modelled. Other forms of capital could be added or broken out for life cycling treatment, or amalgamated into fewer larger pools. Although the various types of capital another nation manages for Defence purposes will be largely the same, whatever their grouping for value modelling, the terminology and the way in which life cycle processes are defined and partitioned will differ. Indeed, because the PAA was originally to be used for organizational reporting, in the course of negotiating its acceptance, it underwent changes to accommodate those who would need an unambiguous place in the structure for their work. In the process, it acquired the inconsistent partitions shown in Table 3. This suggests that a conceptually consistent NVM will need to be shielded from pressures to conform to perspectives and priorities rooted in considerations other than value. We would argue that a tool for strategic decision support faces less such pressure than a global reporting structure for all of Defence. Hence, the de-promulgation of the PAA in 2017 may actually free it for amendment to restore conceptual consistency lost on the way to promulgation, fitting it for greater utility in enterprise analysis, management and communication, which are explored in the next section.

4. Value network exploitation options

In this section, because the motivation for the work has been to model value dynamics within the Defence institution, the principal focus will be on the portion of the NVM that culminate in making ready force elements available, achieving the second strategic objective and fulfilling a necessary precondition to achieving the first. This is the part shown in Figure 7.

The ideas presented in the previous section are pregnant with possibility. The degree of utility realized by their exploitation will be most strongly influenced by the scale and coherence of organizational investment in the value modelling paradigm. This section details specific attributes of an NVM and then describes specific applications of the NVM paradigm and some of the dynamics and challenges anticipated with each.

Section 4.1 provides a survey of the specific attributes of an NVM that suit it for the uses proposed in later subsections. Section 4.2 addresses its use in support of strategic performance and risk management and capital investment characterization. Section 4.3 proposes tailoring these graphics to depict anticipated changes in these types of information over time. Section 4.4 gives a notional illustration of the potential for an NVM to support numerical modelling of institutional capital investments. Finally, Section 4.5 proposes the use of NVMs to foster strategic mindset clarity and commonality among functional L1 authorities.

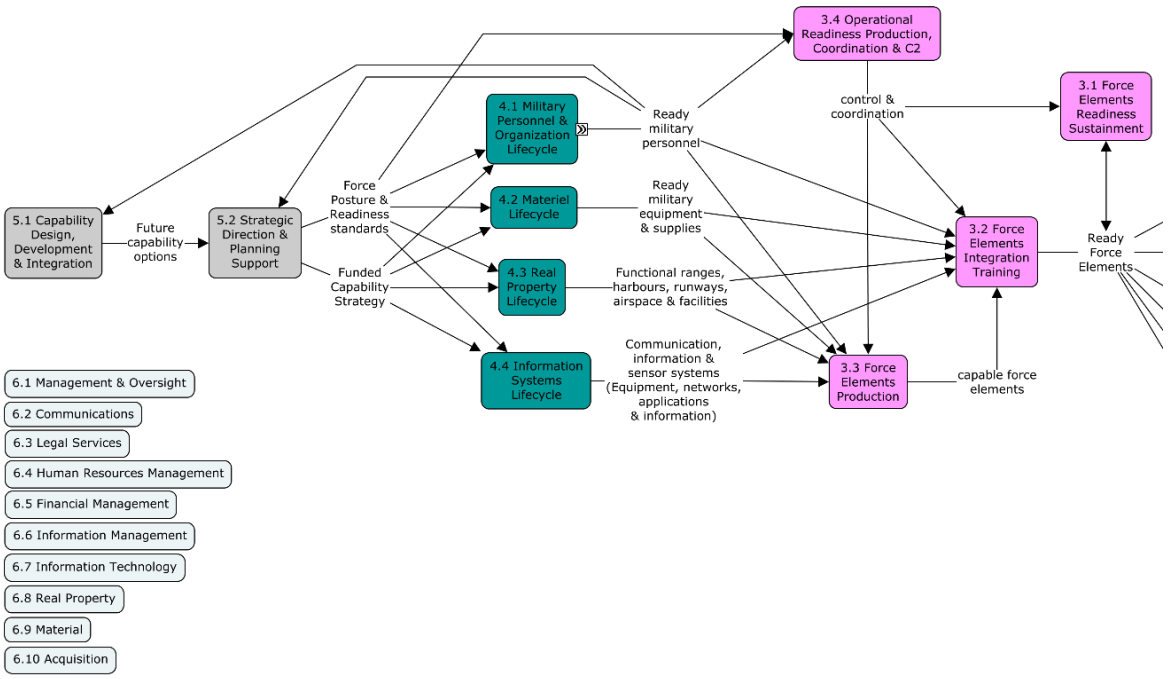

Figure 7: *The Institutional portion of a Defence NVM*

4.1 Attributes of the prototype networked value model

Types of value and the transformations between them within Defence change very little over time. Even though Command and Control networks relied 150 years ago on bugles, courier satchels and carrier pigeons, Figure 4 still speaks to the variety of issues to be managed in delivering national defence sustainably and affordably. Accommodation of that past reality in Figure 7 requires only a new SP called Livestock Life Cycle.[9] In contrast, it is arguable that *no* Defence organization has survived intact for that period of time without substantial change. The point here is that an NVM is **relatively permanent**. Its functional utility endures changes in government, doctrine (from tactical through strategic), policy, organization, technology, security environment and strategy. Indeed, having an enterprise NVM can greatly simplify the process of satisfying central agency requirements whenever they issue a new standard for program structure description.

The NVM is **holistic**. It spans the entirety of Defence at levels of detail suitable to informing enterprise-level decisions. It represents (and enables more specific definition of) the intrinsic interconnectedness of Defence, providing a structure to which organizations can be mapped according to the type of value they create and manage. If military personnel need to be taken temporarily from the Defence institution to meet urgent operational requirements, an NVM populated with data on the health of program elements frames quite usefully the analysis of where Defence can and cannot afford disruption, informing predictions of enterprise states in the near term expected from alternative sourcing of military personnel from institutional functions for operational purposes.

The NVM is **scalable**, applying to the value dynamics of units, regiments, services and whole of force. At a whole-of-force level, the SPs in Figure 7 are generating forms of capital across all

[9] In the early 1900s, a hot army capability question was "Horse: fighting vehicle or troop carrier" (18)

services. When applied to an army unit, it includes only the subsets relevant to the capabilities that their own force elements provide and their place in various operations, institutional and military. More on this when addressing versatility, below.

An NVM **shows dependency relationships** between program elements and assets. This is important because dependencies are the mechanisms by which small problems have impact and grow to become large problems. Every organization is playing one or more roles included in the model. Dependencies show how difficulties can spread through the enterprise if not managed.

An NVM tells a story that non-defence specialists will find **comprehensible**. That becomes especially important when the audience holds the purse strings. In Canada, Defence routinely turns back money it had but could not spend on capital investments and part of that is through lost precious time and opportunity through presentations not being understood by central agencies. Instead of using their appointed time-slot to present new projects seeking expenditure authority, they have had to revisit previous projects unclearly presented and answer questions that lingered in central agency understanding from a previous presentation. It is difficult to say whether these disconnects with senior executive reasoning are about specific military capability arcana or a preoccupation with idioms, references and jargon unique to Defence subcultures.[10]

An NVM is a very **versatile** lens through which to view everything going on in Defence. It affords a way to see the value dynamics associated with many different dimensions. Locations, organizations, trades, capabilities and demographics each have their value narrative to be seen in the NVM:

- The framework provides an instructive view of military capability production. Every SP shown in Figure 7 has a direct impact on every capability in the taxonomy of military capabilities, showing the processes in which they are first conceived, then proposed, planned, prioritized, procured, produced in capability elements and then in ready force elements before possible use in operations. Not one of the SPs is capability specific. Thus, the importance of institutional functions to capability production can be apportioned 100% to exactly these SPs. (The significance of this fact for institutional investment value modelling is illustrated with a notional example in Section 4.4.) This feature highlights the fact that the directed graph connecting the SPs in Programs 3.0 – 6.0 shown in Figure 7 is perfectly orthogonal to any taxonomy of military operational capabilities (not shown in this paper). In the "tooth-to-tail" metaphor of military efficiency, the NVM underlying Figure 7 gives the intrinsic anatomy of the tail through which every aspect of every capability passes on its way into readiness for operations.

- Every location in Canada containing Defence infrastructure plays a role in the processes by which Defence fulfils its mandate. A very practical starting point for Business Continuity Planning at any location is to situate the value adding processes conducted there on the NVM and consider the downstream effects of an incident taking that location

[10] To be fair, the incidence of central agency misunderstanding is likely greater for military capability investments (about which the NVM presented here has less to say) than for Defence institutional investments. However, we would assert that an effective argument comes readily from an outcome-based approach that illustrates the utility of advanced capability technology by contrasting the way in which conflict is expected to play out with the present and proposed systems, specifically framing the narrative around things of value, whether intrinsic (life, property, health, order) or specifically military (lethality, persistence, mobility, initiative, morale). A story about what happens to what is precious resonates universally.

offline. The NVM, as long as it is built out to at least acknowledge the existence of each type of value added and the assets receiving the value, offers a structure for ensuring that the analysis visits every modelled value-adding or transforming dimension.

- The operational failure in theatre of some part of a deployed force will have a back-story that can be meaningfully investigated along NVM lines. Its results will also find clear structure for presentation in an NVM. The same is true when seeking to understand any Defence success or problem having systemic aspects. An NVM can frame the causalities of any part of the story.

- The environment of the Defence institution is a complex one, influenced by demographic and economic pressures, government fiscal restraint, resource competition with other national public services, national politics and a citizenry more connected to social media than broadcast media. Defence depends deeply on national labour markets, public trust, contracted defence services, government resources and support, and information about changes to the security environment. Articulation of an NVM below the SP level supports coherent polling of the current and potential impact of these external dependencies to develop a nuanced assessment of where Defence is robust or fragile, and then a tool to show the aggregated results.

- Well managed programs have targets set after careful consideration of upstream capacity and of downstream outcome requirements and sensitivity. Bringing all the information most relevant to program health and robustness against shocks together in the same place makes assessment and subsequent executive discourse much more meaningful, reducing the likelihood of one-dimensional or incompletely formulated assessments. An NVM also sets up a much better resource allocation (or reallocation) dialogue.

Each of the above illustrations is fundamentally about either enterprise performance, enterprise risk or both. Together, performance and risk data perfectly frame every strategic-level conversation and, in particular, the prioritization of demand for new capital investment. The NVM provides a perfect **canvas** for depicting performance, risk, capital need and capital supply, as Section 4.2 will begin to elaborate.

The idea of life cycling activity as actions taken to protect and enhance what is valuable can be applied to all PAA SPs, not just Programs 3.0 and 4.0. Table 4 lists, beside each SP, a brief description of the portfolio of valuable things to which the SP adds value and, hence, in the life cycle of which the SP plays at least a partial role.

Table 4: *Application of the life cycling metaphor within the 2014 PAA (9)*

PAA Program Element	Assets life cycled (even partly)
1.1 Domestic & Continental Defence Operations	Stability and security in Canada's immediate environment
1.2 International Combat Operations	Global Stability and Security
1.3 Ongoing Centralized Operations & Operational Enablement	CAF Operations
2.1 Disaster Relief & Humanitarian Operations	Global Human Safety
2.2 Defence Services for Canadian Safety & Security	Safety and security of Canadians
2.3 Military Heritage & Outreach	Canada's relationship with the CAF
3.0 Defence Ready Force Element Production	CAF force elements

PAA Program Element	Assets life cycled (even partly)
4.1 Military Personnel & organisation Life-cycle	Military personnel, Defence organisations
4.2 Materiel Life-cycle	Military platforms and equipment
4.3 Real Property Life-cycle	Defence lands, military airspace & harbours
4.4 Information Systems Life-cycle	Military-specific networks and applications
5.1 Capability Design, Development & Integration	Military capability futures
5.2.1 Strategic Capability Planning Support	CAF capability portfolio future
5.2.2 Strategic force Posture Planning Support	CAF readiness
6.1 Management & Oversight	Defence enterprise processes
6.2 Communications	Relationships with Defence stakeholders
6.3 Legal Services	Legal risks
6.4 Human Resources Management	Civilian personnel
6.5 Financial Management	Defence appropriations
6.6 Information Management	Defence information
6.7 Information Technology	Defence non-military computers and networks
6.8 Real Property	Real property for Internal Services
6.9 Material	Materiel for Internal Services
6.10 Acquisition	Acquisition initiatives

By now it should be apparent that an NVM is **intrinsically strategic**, because it acknowledges and enables characterization and analytical exploitation of the connections between all the different parts of Defence.

Perhaps the most important attribute of an NVM to understand is that it is **functionally defined**. It is organized around the types of capital and the value dynamics into, within, out from and between them. It follows from this that organisations adding the same type of value to the same type of asset are, by definition, participating in the same part of the NVM. This aggregation is core to its ability to address value so directly and economically.

This reference to capital type has been uncomfortable for military communities that bristle at the thought of grouping *e.g.* ship, tank and aircraft maintenance into the same SSP, provoking resistance to its adoption and use. Factors driving these challenges may include "strong service model" attitudes that delegitimize centrally defined constructs not emphasizing the importance of specific military services and distinct service identity, and a perceived threat to service influence in the zero-sum competition for strategic resources.

In Canada's case, the problem was aggravated by the central policy requirement that each PAA program element be governed by a single office, implying that SP oversight would be by a single office, to which the offices overseeing SSPs within the SP would be accountable. Thus, service-specific authorities overseeing service SSPs must all answer to a single office overseeing the SP. When those overseeing SSPs are in completely different organizational hierarchies, this is not feasible. The requirement effectively dictated an alignment between a hierarchical program structure and the hierarchical organizational structure of Defence. Yet, complaints of central agencies regarding previous Defence PAAs was that they were effectively duplications of the Defence organizational chart. Simultaneous requirement of an outcome-based program hierarchy and a matching governance structure is a set-up for Defence non-compliance.

To be fair, civilian organizations within Defence can trip over the same impulses. While DRDC research centres do most of the R&D toward capability enhancement, shown in Figure 6, it is also conducted somewhat by companies under contract to the L1 for Defence materiel, in support of

equipment acquisition. Also in Figure 6, while DRDC CORA is the main source of S&T-based decision support, it is also provided by contractors engaged to maintain and operate an Oracle Endeca Information Discovery facility working for the Chief of Force Development under the VCDS (the most senior of the L1s). Working within DRDC CORA, one sometimes falls into thoughts of "owning" the decision support part of SSP 5.1.3, but it is a function that others can and do provide.

This highlights an important tension between conceptual consistency and practical management of defence processes. Any framework that is to serve as an aggregation structure across Defence will be practically limited in its detail to the extent to which the things aggregated are defined in common terms. If the framework fits some organizations but not others, some type of accommodation must be negotiated, either changing the framework (degrading its power as a strategic lens) or changing the way in which at least some organizations manage or report their activities. Without organization-wide commitment to the principles on which a framework is designed, these conflicts will be resolved by making the framework comply with organizations. This can be challenging when organizations are as different as army, navy and air force. Full realization of the power of an NVM to foster common and clear strategic perspectives will depend on senior commitment.

These dynamics suggest that development and use of an NVM may be most fitting at the executive / general officer / flag officer level where roles specifically require that incumbents set aside narrower military occupation and service loyalties and interests and broaden their scope of concern to embrace subsets of Defence operations that are not service-aligned.

4.2 Picturing performance, risk and capital investment

Optimal decisions come from accurate understanding of the present and realistic projection from that state into decreasingly knowable series of future states associated with decision alternatives. In essence, every fully-informed resource allocation decision is a selection for investment toward realization of a series of expected future states from among a pool of alternative series of future states. What matters most about each future state is how well it serves fulfilment of the Defence mandate. This section explores the terms in which Defence futures are best modelled.

A central reality of Defence, as with all of life, is that things untended fall apart on their own in myriad ways. Defence-relevant things naturally transition from more useful to less useful states. There are continuous and discontinuous modalities of this degradation. Difficult to predict step-wise changes in asset usefulness combine with more predictably continuous transitions into less useful states. Whichever predominate, value in all of its forms is perishable.

The value that is added by a Defence program element, to the extent that it is needed, makes its way in some form into Defence's final products. This implies a level of sensitivity in the final outputs of Defence to performance levels in the program elements involved in its production. Hence, the natural next step after articulating expected outcomes and a networked value model is to recognize program element targets and metrics by which leaders can monitor their degree of attainment. The dependencies within the networked value model and their strengths suggest which among all possible value item attributes are the more important to monitor. Metrics enable decision-makers to get control of program element performance. A networked value model steers attention toward performance attributes on which outcomes depend more strongly.

Performance can be thought of in part as how well value producers satisfy the value requirements of the enterprise (effectiveness), which includes the value requirements of program elements that

will take its outputs as their inputs, though it also includes the scale of resource inputs needed to realize the value delivered (efficiency). Performance includes the quantity and quality of both product and producing process, but it also concerns the variability in those levels, which reflects how well production is being controlled. Recall, also, that each of the SSP value networks shown above had at least one white boxes outside the enterprise supplying needed capital input toward production. These external sources represent dependencies on something originating outside of direct Defence control. These sources of variance constitute risk, which is about uncertain effects on the attainment of objectives[11] (10). Value production that Defence can control is about performance, and that which it cannot control constitutes risk. Thus performance and risk constitute the two fundamental lenses through which to view mandate success in Defence. Every case for a capital investment, as with that for every type of strategic initiative, can be decomposed into elements of performance and risk.

An NVM serves as an enterprise canvas or scaffolding on which to hang depictions of performance and risk information. Figure 8 illustrates the idea by superimposing a variety of effects on the value model of Figure 1. For example, as mere exploration of effects without any pretense of a coherent legend:

- The faint yellow background of the value added by SP 4.4 might signify emerging production quality issues. The gold box around it might signify a recognized risk level associated with a fragile SP likely to fall over with perturbation of some of its inputs;

- The thick line passing beyond the products of SP 4.3 might suggest that production exceeds the actual volume requirements of the consuming process;

- The thick red line leading from SP 4.2 might indicate that those executing materiel acquisition projects are completely maxed out, and that there is little residual capacity to bring new materiel delivery projects online until more experienced capital project managers can be hired and the capacity to move expenditures through the authorization process can be surged to spend the funds already allocated;

- The thick gold line to SP 3.3 might indicate logistic challenges getting serviceable equipment to where it is needed. The dotted and dashed line to SP 3.3 might indicate uneven personnel training issues due to sick buildings causing instructor illness or stressed trades making training personnel unable to meet the training schedule;

- Yellow “capable force elements” from SPs 3.3 to 3.2 might indicate quality issues with combat teams emerging from their first tier of collective training;

- The thick black flow of Ready Force Elements coming into SP 1.3 may be an over-production problem; and

- The thick line from SP 2.3’s products to Canada might signify particularly high desirable impact from otherwise standard levels of effort connecting to Canadians because of a heroic rescue of an instructor suffering a heart attack at sea by Navy Cadets.

[11] ISO 31000:2009 (8) defines Risk as “the effect of uncertainty on objectives”. We prefer “uncertain effects on objectives” over that definition, risk being effects on objectives that may or may not occur.

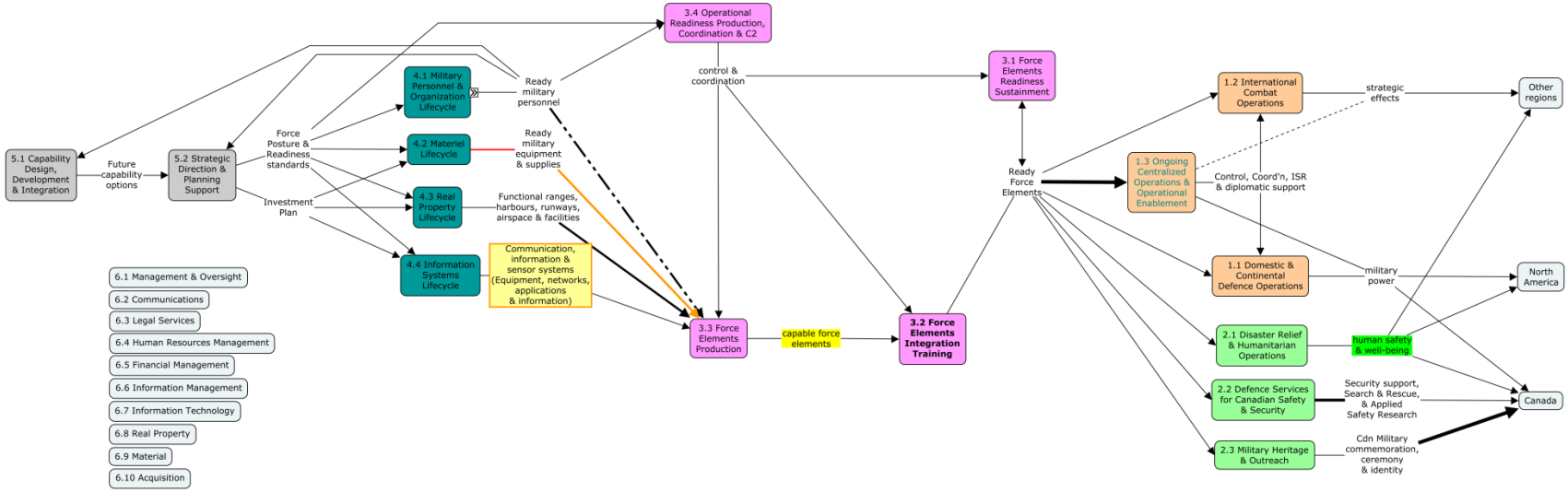

Figure 8: *An illustration of strategic metric depiction on a Defence value map.*

Please note that no claims of fitness are being made for any of the specific depictions shown here. They simply illustrate the feasibility of a concept. Successful implementation of the suggested approach will require user experience expertise and some organizational trials to validate the power of specific graphical schemes and symbolic language to be introduced for wide use.

What makes the networked value model particularly fitting for depicting performance and risk issues is that the impact propagation path is right there in the direction of the arrows. This engenders very organic mental associations with both performance and risk. This way of depicting strategic metrics is equally as applicable to Figures 3 through 6. That said, use of NVMs to identify and then depict risk makes it particularly important to include in the model every form of input value on which Defence relies, not only for raw value material, but also for critical enabling value-adding processes. These are the specific sources of shock over which Defence has limited control.

4.3 Showing strategic metrics over time: capital investment value

Value network depictions similar to those in Section 4.2 can be used to show impact on expected *future* performance and risk levels, though the NVM is most usefully applied to institutional investments[12] using Figure 7 as a frame on which to hang risk and performance metric symbology. The only necessary added feature is unambiguous indication and control of the time frame. This enables presentation of a complete picture at whatever level of precision is deemed appropriate to the available information. Readily shown on NVM graphics are:

- Expected impact from planned changes in law, regulations and government policy;
- Projections of economic, demographic, and technological trend influences;
- Projected value and cost metrics associated with deteriorating capital assets;
- Burdens from required support to scheduled force commitments;
- Anticipated impact from scheduled delivery of capital investments underway[13]; and finally
- Impacts expected from scheduled delivery of specific investment alternatives.

The graphical result, presented to either build in layers separating each of the above influences or transitions through time epochs, will provide intelligible and nuanced pictures of enterprise future states. These can build a strong basis for strategic investment decisions. Though they will take effort to build, the familiarity of an NVM framework will directly support clear interpretation of the metric graphics that it wears, providing a rich and clear decision context. The power of such depictions and the applicability of this structure and approach for informing executive decisions on L1 through L3 mean that an investment in tools that streamline the projection of standard metric graphics and their convenient timeline navigation will deliver value in several settings, not merely in the L0 domain.

From the perspective of informing selection from among capital investment alternatives, time-specific metric visualization on the NVM frame permits direct side-by-side comparison of the most relevant dimensions of future enterprise trajectories with and without specific investment delivery. To the extent feasible, the technique becomes even more powerful if standard aggregation symbology is developed to depict different futures implied by different investment portfolios. This will provide strong support to clear and dependency-informed comparisons of strategic alternatives. Obsolescence, project delivery schedules, announced regulatory changes, temporal constraints on funding availability, monitored

[12] Military capability investments are better depicted on a frame designed around military capability, not shown here.
[13] This should include initiatives addressing intangible forms of capital such as those addressing defence culture and other relevant institutional dynamics.

changes in everything from climate to demographics all find a natural presentation language that automatically addresses the question "So what?"

The functional health and especially the residual capacity of specific value-adding organisations within the enterprise over time is important to consider if the merit of strategic initiatives is to be properly understood. Solutions can initially make problems worse, and burdens may need to be shifted somewhere else for the short term. Depicting not only the benefits but the placement of the execution burden and the residual capacity of those that will carry it is necessary for a holistic understanding of a strategic alternative. These all have natural NVM depictions.

At the Programs 1.0 and 2.0 end of the value model, leadership discourse is intrinsically results-oriented with central focus on "Commander's Intent". The language of value makes that same focus available right through the enterprise, from civilian recruiting and IT support all the way to advice to the Prime Minister.

4.4 Institutional capital investment value modelling

The initial motivation given in Section 2 for this investigation was to discover how better to generate insight toward sound capital investment trade-off decisions. The near-term objective was to develop a value model that turned investment attributes into a number that quantifies deliverable value the way we quantify expenditure. The terms on which value modelling has been described and pursued here do not directly meet that end. Rather, they provide a framework within which questions concerning the impact of a problem and the desirability of alternative solutions can be explored in practical terms that acknowledge the larger picture.

With the networked value model and defined performance targets based on output-input dependencies, it becomes straightforward to discuss how sensitive the performance of a downstream value-adding process is to upstream process performance. When examining the ability to deliver military effects in a particular tactical scenario, the dependencies of capability effectiveness on the whole array of capability production process outputs and performance levels can be systematically reviewed one at a time according to relevance, and then in combination where interactions are expected between the performance levels of two processes. A system for recording and consistently aggregating these sensitivities would, in principle, enable the estimation of the relative sensitivity of any capability to each of the processes that enabled it to be produced and made available to a mission. Since all produced capabilities originate from the womb of the Defence institution, the sum of the dependencies of every capability to the value adding processes of the defence institution is 100%. This is a statement of considerable consequence for assigning value to capital investments in the defence institution.

To illustrate using simplified linear process assumptions and hypothetical data, suppose that a detailed assessment of the proportional dependency of ready force production on the various functions of the Defence institution were done to enable the following assertions:

- 14% of the ready force production value in the institution comes from SP 4.1 Military Personnel & Organisation Lifecycle.
- 13% of that value comes from SSP 4.1.7 Military Personnel – Morale & Well Being.
- 40% of that value is delivered by fitness centres on military bases.
- Of all fitness centre-delivered force production value, 9% is provided by stationary strength training equipment, etc.

- The performance of the existing stationary strength training equipment portfolio is estimated to be 55% of what ideal equipment could achieve.
- A project proposes to replace 85% of the stationary weight equipment in CAF fitness facilities.
- The new equipment is estimated to perform at 90% of the ideal for such equipment.

Figure 9 is a Venn diagram depicting this value partition and the increment promised by the stationary strength training equipment investment candidate.

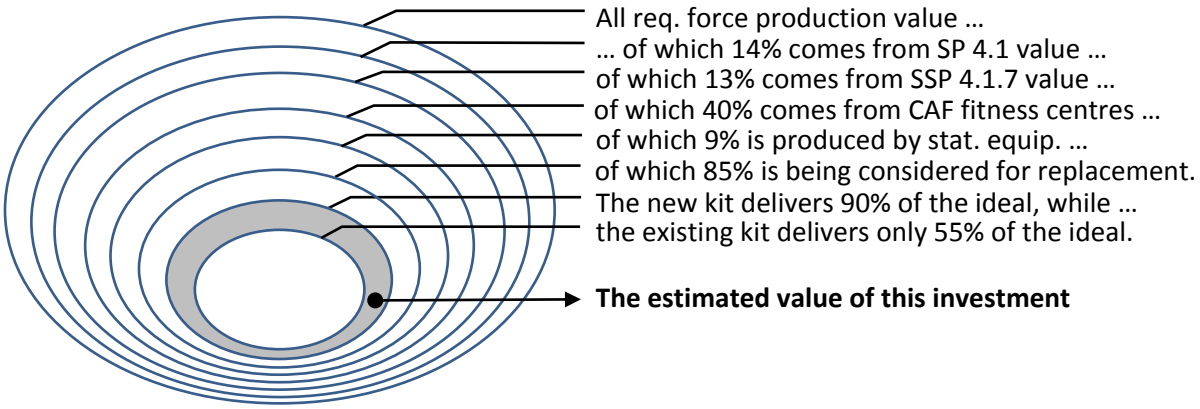

Figure 9: *Venn diagram of the value of replacing exercise equipment*[14]

It now becomes possible to assert that the replacement project, if executed as planned, will deliver:

$$14\% \times 13\% \times 40\% \times 9\% \times 85\% \times (90\% - 55\%) = 0.0195\%$$

of all the capability production value of the entire Defence institution.

If the force development analysis can claim to assign relative value to each of the military capabilities offered by the CAF in their current state for achieving Defence success, and every capability owes its entire existence to the Defence institution, then whatever the sum of the value of all capabilities is, that is the sum of what the institution delivers. This approach to investment value calculation puts the institution on an even footing with everything the military does on operations, and it is made possible by a coherent and complete model of value.

That said, it assumes that *every* type of capital value generated within the Defence institution toward delivery of military capability has been identified in an explicit framework of value and process by which the value is life-cycled, including assigning value to the life cycles of everything on which military capability somewhat depends, things like business processes, organisation constructs, IT services, corporate knowledge, organisational project management capacity, legal risk management, etc.

Employment of an NVM provides a useful framework for bringing rational order to otherwise sensitive adjudications between interests. In the long term, it would change the way in which the Defence institution is viewed and valued within military services.

[14] Note that the outer six circles in Figure 8 represent value partitions, while the two inner circles represent performance metric values.

4.5 Fostering strategic clarity

Another application of an NVM is to establish it as a regular point of reference in executive communication. For example, it might be directed that the first descriptive slide(s) of every presentation requesting executive committee authorization to advance on any initiative requiring L0 approval make explicit where the initiative is playing in the networked value model, specifying both the capital it will draw on (execution burden) and the value it will add to Defence operations once it has delivered its results. Both of these need to be considered against the degree of flexibility, stress or risk in institutional functions in order to understand the trade-offs inherent in the initiative and the cost benefit proposition it embodies. This is of particular interest at the strategic level when the initiative is part of a horizontal initiative across departments and is disruptive to defence operations, having an overall negative value to defence production. Such analysis can help with follow-on conversations with government to obtain resources necessary to meet new government expectations.

Benefits expected from implementation at this level include:

1. A more habitually strategic focus on value in communication within the senior levels of Defence;

2. The opportunity to demonstrate to government systematic commitment to results-based management and an effective approach for defining value in Defence management;

3. Systematic focus on strategic level risk in holistic terms not simply confined to a corporate risk profile satisfying policy, but actually aiding in ongoing strategic risk management; and

4. Generic language for communicating outside of Defence that makes conversations with government shorter and more satisfying, ultimately fostering increased levels of government trust in Defence.

Reception would likely vary within Defence. Transparency of Defence business processes better informs Defence evolution and enhances internal accountability, although this can represent a shift in the balance of internal political power from L1 toward L0. However, it would also enhance the general understanding of the design of Defence and the sense of connectedness, enhancing appreciation of the part each plays in the better-understood whole.

Clearly, each nation defines, manages and understands the role of military forces within their national life differently. An NVM is useful only to the extent that it reflects those conceptions and practices. The next section provides guidelines for developing the elements of a Defence NVM.

5. Practical building and use of a networked value model

Thus far, we have introduced the problem of numerically modelling capital investment value, an approach to modelling and depicting graphically how value is created and managed within defence and then outlined some applications, both for addressing the numerical value modelling problem, for fostering a value-focussed mindset at the strategic level, shaping strategic conversations both inside and outside Defence. In this section we address practical challenges to building and exploiting an NVM.

In Section 5.1, we infer a logical sequence of questions, the answers to which provide the elements of an NVM applicable to any enterprise. Then, in Section 5.2, we briefly address practical aspects of NVM adoption and use.

5.1 Building a capital-based networked value model

The first seven items in the guidelines to value modelling offered here were developed by inference from the structure and the attributes of the content of the 2014 Defence PAA as documented in (4) by Chad Young, its chief architect. The process by which he led its development was thoroughly iterative, beginning from the frustration of trying to use the 2009 PAA for what it was unfit to do and then exploring what could be found in government guidance and related literature to develop something better. It was a probing exploration of alternatives, testing of concepts and strategies, groping toward a scheme that would result in a structure that had the right properties. Investigation eventually led to the still developing field of Business Architecture. As understandings became more mature and false starts were better understood, the terms gradually emerged on which a capable PAA could be developed. Hence, that (4) does not provide a tidy report of PAA development should not be surprising; it was not at all tidy because the principles embodied in the end result had not yet been formulated. Terms on which the complex endeavour of Defence could be framed to satisfy very generic central agency requirements had to be imagined. Then negotiation was necessary to persuade them of the utility of relaxing those requirements to enable fulsome satisfaction of their most important criteria. (11)

The preparatory guidelines below are formulated as questions that, once answered, enable the construction of an NVM. The questions are fairly straight-forward, although recognizing relevant answers requires quite specific mental orientation. The questions follow a logical structure in which you can only frame later questions around information found that partially answers earlier questions. The guidelines are only partially formulated, as they do not define a path that leads to all the desirable attributes of the PAA, let alone an ideal NVM. Hence, until guidelines develop further, NVM construction will still necessitate iteration informed by creative judgement.

1. What outcomes are mandatory for the enterprise to seek?

Modelling value begins with an understanding of enduring purpose. In the public service, purpose will have formal definition to some degree in legislation and government policy, though these may not articulate explicit mandated outcomes. Business architecture activity within the enterprise may have sought and developed succinct and more useful purpose formulations. These are most useful when expressed in terms of outcomes that are not going to change over decades. Outcome statements that explicitly identify what is intrinsically valuable will set a useful foundation for value modelling. More than one outcome statement may be needed to properly span the mandated outcome space and usefully aggregate the essential components of national expectations.

2. What effects must the enterprise deliver to achieve those outcomes? What mechanism(s) deliver those effects?

How does the enterprise intervene to create, foster or reinforce these outcomes? A full listing of enterprise outputs (products and services crossing the boundary of the enterprise to influence something outside of it) will enable complete value modelling. Outputs other than those that are obvious should be included, as they may come from distinct mechanisms that play an important role. Aggregation of outputs in the value model can be considered later in the process if necessary.

3. What assets deliver these effects? (What are the forms of producing capital? Does Defence rely on assets outside of Defence?)

Everything an enterprise does to affect its domestic or global environment is done through assets that act directly to deliver those effects or play an essential enabling role in their delivery. Identifying those assets, at least in their type, will clarify how it pursues its mandate. It will also focus attention on what

Defence does to ensure these assets are effective. Assets need to be managed. Secondary but necessary outputs should also be taken into account, delivered by other forms of capital including possibly civilian communication teams, external but enterprise-supported organizations, and others. Assets may be tangible or intangible. They each represent different forms of capital.

4. What is needed to generate producing capital? (Include necessary forms of input capital.)

Input capital includes possibly intangible things of enduring value necessary in order to create producing capital. This will include human capital (people) but also materiel (equipment), lands, facilities, information networks, etc. For a broad understanding of assets, consider the US Department of Defence DOTMLPF-P[15] construct, providing a useful structure specifying different types of assets on which US Defence effectiveness depends, as does the UK's TEPIDOIL[16], the Australian FIC[17] and Canada's[18] and New Zealand's[19] PRICIE counterparts. Each represents a different decomposition of military capability production into dimensions that represent types of asset or forms of capital. Different types of capital asset can be thought of as asset portfolios, each defined by the type of asset it holds. Take specific note of those capital inputs originating outside of Defence, as these constitute aspects of Defence that depend upon supplies outside of its direct control, and therefore sources of risk.

5. Where do producing assets come from? How do they lose utility and how is their usefulness restored?

For those life cycle processes triggered by the condition of an asset, describe the conditions of assets each life cycle process receives and the conditions of assets they deliver. These descriptions should imply the reason for the asset entering and leaving the life cycle process, and will be used in construction of networked value model graphics.

6. What processes ensure the utility of these forms of capital and how are they triggered?

Life cycle processes make useful assets available. Besides acquiring and disposing of assets, life cycle processes also augment and renew the qualities that make the assets in the portfolio useful and that mitigate the conditions that reduce their usefulness. They will often have analogous counterparts in the life cycle processes of other forms of capital, though they will vary in the way they are grouped for managing.

[15] DOTMLPF-P stands for the elements of solutions developed by the Joint Capabilities Integration Development System. These elements include Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, and Facilities, all of which is managed according to the priorities and constraints of Policy (12).
[16] The acronym TEPID OIL stands for Training, Equipment, Personnel, Information, concepts and Doctrine, Organisation, Infrastructure and Logistics, constituting the UK Defence Lines of Development (DLODs) (13).
[17] The Australian Defence Organization's Fundamental Inputs to Capability (FIC) construct includes Command and Management, Organization, Major Systems, Personnel, Supplies, Support, Facilities, Collective Training and Industry (14).
[18] The DND/CAF PRICIE construct stands for Personnel; Research, development & operational research; Infrastructure, environment & organization; Concepts, doctrine & collective training; Information; and Equipment (15).
[19] The New Zealand Defence Force uses PRICIE to stand for Personnel; Research and development; Infrastructure and organizations; Concepts, doctrine, and training; Information technology; and Equipment, logistics and resources (16).

The following is a generic life cycle process pattern seen in the PAA that may help identify missing or analogous processes. Those marked with asterisks are not specifically triggered by the condition of an asset but represent ongoing asset data collection and evaluation and life cycle process management.[20]

- *Portfolio management: Monitor portfolio element conditions against requirements, plan condition mitigations, monitor mitigation results,
- Move elements where needed,
- Acquire new elements,
- Upgrade existing elements,
- Maintain existing elements,
- Protect elements from threats & hazards,
- Dispose of old elements,
- *Manage relationships with element stakeholders,
- *Manage life cycle process performance and risk, and
- *Evolve life cycle process requirements.

Consider whether or not each of the above generic processes would apply to each of the asset types. If they logically would apply, are they already included in the processes listed or does another process need to be identified?

7. Can assets managed by different organizations be aggregated across the enterprise into the same class?

The versatility of the NVM presented here derives partly from its identification and grouping of common assets by their class. Asset aggregation within the model by asset type simplifies the model and also raises useful questions around why different specific assets in the same class are managed differently. Some of the answers will be "because we always have" and present real opportunities to manage more effectively and enable lessons learned to be applied across organizations.

8. Which life cycle processes rely on contracted services?

Contracted services greatly enhance the flexibility of an enterprise by augmenting or completely outsourcing services for short-term flexibility or long term efficiency. However, they are also sources of risk, because Defence control of their service delivery is limited to the terms of the contract. Performance management is conducted by the company offering the service, and may comply with the terms of the contract but not the evolving requirements of Defence.

9. Assemble these dependency relationships into a model of how mandated outcomes are achieved.

The NVM consists of asset linkages between value adding or transforming. It can be defined by ordered triples, but only becomes fully exploitable in a database designed specifically to house its structure along with the associated performance and risk metric data and to make it available for a supporting graphical engine and a variety of other analyses.

10. Develop graphics showing life cycles and the transformation of assets.

[20] Business processes can be thought of as assets and they may be managed separately, depending on the status of Business Architecture as a discipline within the enterprise. The list here includes processes that are managing the life cycle processes as well as processes managing relationships (another class of asset) with stakeholders interested in the condition of or processes surrounding the assets, as part of the list of processes managing the assets themselves.

Identification of a generic process representing assets in their useful / in-use state can serve as the producing process of degraded assets that then enter life cycle processes and as the consuming process for renewed or enhanced assets, where applicable. A useful convention is that assets are acquired from the left, are used near the middle, disposed of at the end of their useful life to the right, improved or upgraded above the middle and maintained or restored to a useful state below the middle. Set a boundary to clarify what is inside and outside of Defence. Services that are contracted originate outside the enterprise and cross the boundary to provide outsourced value. The result is a state transition diagram for each type of asset. Each process is said to produce the assets emerging from it and to consume the assets entering it.

5.2 Practical aspects of NVM development and use

Part of the motivation of this paper is to work through the principles of value modelling in preparation to build a new Defence networked value model. The need to do so arises from changes in central policy that now require not a Program Alignment Architecture but a Departmental Results Framework (DRF) defined on somewhat different terms. Its respective counterparts to programs and sub-sub-programs are core responsibilities and programs (in a program inventory). Evolution of the structure reflects military disaffection with the PAA, disrupting its capital value coherence with a more organizationally-recognizable core responsibilities. However, many of the SSPs have translated directly into DRF Programs. Many of these have been further broken out into capital-coherent program segments that make their role in Defence value management even clearer. However, others represent amalgams of formerly distinct SSPs, although some use has been made of program segments to reconstruct the original SSPs with some organizational reinterpretation.

A director within the VCDS staff has asked for a Defence value model defined in terms of DRF programs and program segments. The guidelines of the previous section constitute part of our preparation, though they are not expected to survive contact with the task. An important starting point and comparator for the work will be the PAA-based NVM of this paper.

At this point, the only practical aspect to offer here has to do with issues surrounding a program structure that is not organized around forms of capital. Structures that break-out separate program elements by organization provide the opportunity to show how they may be usefully aggregated in strategic analysis products. A more serious concern is program elements that treat more than one type of asset, concealing the very patterns an NVM exposes. For now, the only advice is to:

1. Note the specifics of each instance of program elements aggregating disparate value processes;
2. Rate each instance for the degree of disruption it poses to value modelling;
3. Rate each instance also on the estimated degree of disruptiveness to Defence processes for the program element to be segmented along the lines of capital type; and then
4. Prioritize efforts to amend the program structure for the sake of coherent value modelling beginning with those most disruptive to coherent value modelling and least disruptive to Defence processes to amend.

6. Conclusions

This paper has proposed a way to foster and support strategically relevant and commonly understood discourse acknowledging the dynamics of value within the Defence enterprise. The approach highlights the many recurring patterns running through Defence, patterns otherwise disguised in sub-cultural jargon. It helps people build mental connections between what they work with and know well and the big picture about which they may have relatively little knowledge. It formally defines a networked value model as a

useful construct supporting value discourse but also providing a very practical, enduring and relevant lens on Defence operations, provided the Defence program structure supports its creation. It also offers a few early artifacts coming from such a model and proposes its specific application to supporting strategic investment decisions, managing Defence culture and fostering trust and understanding between Defence and government.

The language of value shines a clear light on the complete dependence of military capability on the Defence institution. It makes Canadian terminology like "the Defence Team" more meaningful and properly dignifies contributions to Defence occurring well back in the tail. From a technical perspective, networked value models can lead pretty compellingly to numerical value models, and these provide a new source of light to shine into resource allocation discussions. It bridges the gaps created by sub-culture jargon by initiating Defence-relevant but service-neutral terms that emphasize what is common to every branch of Defence and shifting the Defence mindset away from outputs toward outcomes. It frames the core dimensions of Defence in a way that non-defence specialists will understand, and does so in a way that endures beyond changes in organization, policy and even government. It is the kind of language that every accountable MoD has good reason to develop, learn and use.

It must be acknowledged that the approach advocated here does constitute a significant change and will encounter opposition. Unless leaders present the supporting case clearly and thoroughly, institutional inertia will prevail. Success will depend upon progressive Defence seniors willing to expend personal capital on strategic innovation with Defence institutional culture by adopting:

- A straightforward approach that links all of Defence (and any other public sector work);
- An elegant, versatile and enduring set of tools;
- A way to makes strategic investment impact clear to those holding the purse, and
- Artifacts that emphasize and celebrate what connects the entire Defence team.

For Defence in Canada, there is some immediate work to do. The transition beginning in 2016 from a capital-coherent Program Alignment Architecture to a more organizationally-defined Departmental Results Framework sets back the modelling of Defence value. As the details of the supporting Program Inventory are being finalized, a new value model populated with the DRF programs and program segments is to be developed, offering a practical test of the NVM development guidelines offered here. Once constructed, we will be working toward a fuller appreciation of where value modelling leads and seeking fuller realization of the potential benefits illustrated here. We hope that other MoDs will join us in this venture.

Afterword

The opportunity to write this paper is timely. It has developed a topic included in the author's original specification for a proposed multinational collaboration under the NATO Science & Technology Organization entitled SAS-134 Modelling the Transformation of Resource Inputs into Defence Outputs and Outcomes. The collaboration was approved in October 2016 and begun in May 2017. However, this component of its intended aim, to pioneer networked value modelling, did not find the needed traction with the participants to proceed, and we have redefined its scope more narrowly to exclude the topic. With this paper, a fairly definitive explanation of our vision for the topic becomes available, and the intended impact of the work may now be realized outside the SAS initiative, which makes it much easier for us to continue with the rest of our mandate. It is expected that the group, with focus narrowed to

issues more specifically related to strategic investment planning will execute the remainder of its mandate under a name something like “SAS-134 Linking Strategic Investments to Defence Outcomes”.

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Annex A - The Initial CIPPR Value Model

The initial CIPPR objective function was a normalized linear combination of scores computed from the following three distinct value perspectives:

1. **Policy alignment**: Value as reflected in policy artefacts originating above L0, including government programme announcements in Parliament, federal budget documents, legislation, defence policy, prime ministerial and defence ministerial announcements, international treaties, etc. This alignment score was calculated by finding the maximum product of factors representing:

    a. The relative importance of each artefact lending support for the investment, and

    b. The strength of the support lent by the artefact for the specific investment;

2. **Capability**: Value as reflected in analysis products endorsed at L0, applying separate criteria for investments in:

    a. Military capability (delivery of mission effects on military operations) evaluated and then summed over all Force Development Scenarios and all capabilities addressed by a given investment, evaluated using professional military judgements of deliverable utility based on:

        i. The addressed capability's assessed criticality to success in a Force Development Scenario (Critical, Essential, Routine or Not Required);

        ii. The addressed capability's assessed capacity in each scenario (Affluent, Matched, Partial, None);

        iii. Project staff claims of the investment's level of impact on the addressed capability (Sustains, Incrementally improves, or Transforms); and

    b. Institutional capability (delivery of needed effects other than those provided by military capabilities) assessed using project staff claims of

        i. Project claimed impact toward one or more Defence Renewal Initiatives (a portfolio of some 40 initiatives developed to address an implied institutional capability gap) (Supports, Delivers a critical element, or Completely delivers);

        ii. The strength of departmental support for the project implied by text in the annual Defence Report on Plans and Priorities prepared for Parliament, and

        iii. The degree of investment impact on some aspect of departmental operations.

3. **Sponsor Priority**: Value as reflected in the number of priority points assigned to the investment by its sponsoring L1 (between 0 and 20 points) drawn from a pool containing 10 points for each of the sponsor's projects.

Annex B - The 2014 DND/CAF Program Alignment Architecture

Tables 5 and 6 together show the organisation of the PAA.

Table 5: *The 2014 Program Alignment Architecture, Part 1 (Programs 1.0 – 3.0)*

National Defence Program Alignment Architecture (PAA) [P.1 of 2]			
Strategic Outcomes	Programs	Sub Programs	Sub - Sub Programs
Defence Operations & Services Improve Stability & Security, & Promote Canadian Interests & Values	1.0 Defence Combat & Support Operations	1.1 Domestic & Continental Defence Operations	1.1.1 Operations to Defend Canada Against Armed Threats
			1.1.2 Ongoing Defence, Security & Sovereignty of Canada Operations
			1.1.3 Ongoing Defence Operations through NORAD
			1.1.4 Ongoing Continental Defence Operations in Cooperation with US
		1.2 International Combat Operations	1.2.1 International Operations over Extended Periods
			1.2.2 International Crisis & Surge Response Operations
			1.2.3 Ongoing Defence Operations through Standing NATO Commitments
		1.3 Ongoing Centralized Operations & Operational Enablement	1.3.1 Overarching Command & Control of Domestic & International Operations
			1.3.2 Ongoing Defence Intelligence Operations
			1.3.3 Operational Support Services
			1.3.4 Military Diplomacy & Global Engagement
	2.0 Defence Services & Contributions to Government	2.1 Disaster Relief & Humanitarian Operations	2.1.1 Domestic & Continental Assistance & Response Operations
			2.1.2 International Humanitarian Assistance & Disaster Response Operations
			2.1.3 Non-Combatant Evacuation Operations
		2.2 Defence Services for Canadian Safety & Security	2.2.1 Counter Terrorism, Terrorism Event Response & Consequence Management Operations
			2.2.2 Assistance to Major Canadian Event Operations
			2.2.3 National Search & Rescue Program
			2.2.4 Search & Rescue Operations
			2.2.5 Defence Services to other Government Departments and Agencies
			2.2.6 Canadian Safety & Security Program
		2.3 Military Heritage & Outreach	2.3.1 Military History, Heritage & Awareness
			2.3.2 Youth Program
Defence Remains Continually Prepared to Deliver National Defence & Defence Services in Alignment with Canadian Interests & Values	3.0 Defence Ready Force Element Production	3.1 Force Elements Readiness Sustainment	3.1.1 Maritime Roles - Readiness Sustainment
			3.1.2 Land Roles - Readiness Sustainment
			3.1.3 Aerospace Roles - Readiness Sustainment
			3.1.4 Special Operations Roles - Readiness Sustainment
			3.1.5 Joint & Common Roles - Readiness Sustainment
		3.2 Force Elements Integration Training	3.2.1 Maritime Environment - Integration Training
			3.2.2 Land Environment - Integration Training
			3.2.3 Aerospace Environment - Integration Training
			3.2.4 Special Operations - Integration Training
			3.2.5 Joint - Integration Training
			3.2.6 International & Domestic - Interoperability Training
		3.3 Force Elements Production	3.3.1 Maritime Environment - Force Element Production
			3.3.2 Land Environment - Force Element Production
			3.3.3 Aerospace Environment - Force Element Production
			3.3.4 Special Operations - Force Element Production
			3.3.5 Joint & Common - Force Element Production
		3.4 Operational Readiness Production, Coordination & Command & Control	3.4.1 Maritime Environment - Force Element Production, Coordination & Command & Control
			3.4.2 Land Environment - Force Element Production, Coordination & Command & Control
			3.4.3 Aerospace Environment - Force Element Production, Coordination & Command & Control
			3.4.4 Special Operations Forces - Force Element Production, Coordination & Command & Control
			3.4.5 Joint & Common - Force Elements Production, Coordination & Command & Control

Table 6: *The 2014 Program Alignment Architecture, Part 2 (Programs 4.0 – 6.0)*

National Defence Program Alignment Architecture (PAA) [P.2 of 2]			
Strategic Outcomes	Programs	Sub Programs	Sub - Sub Programs
Defence Remains Continually Prepared to Deliver National Defence & Defence Services in Alignment with Canadian Interests & Values (cont'd)	4.0 Defence Capability Element Production	4.1 Military Personnel & Organization Lifecycle	4.1.1 Military Personnel - Regular Force Portfolio Management
			4.1.2 Military Personnel - Reserve Force Portfolio Management
			4.1.3 Military Personnel - Recruitment
			4.1.4 Military Personnel - Transition & Release
			4.1.5 Military Personnel - Professional Development Training
			4.1.6 Military Personnel - Occupation Training
			4.1.7 Military Personnel - Morale & Well Being
			4.1.8 Military Personnel - Health Care
			4.1.9 Organization - Security, Protection, Justice & Safety
			4.1.10 Military Personnel & Organization - Strategic Coordination, Development & Control
		4.2 Materiel Lifecycle	4.2.1 Materiel - Portfolio Management
			4.2.2 Material - Acquisition
			4.2.3 Material - Equipment Upgrade & Insertion
			4.2.4 Materiel - Divestment & Disposal
			4.2.5 Materiel - Engineering, Test, Production & Maintenance
			4.2.6 Material - Inventory Management & Distribution
			4.2.7 Material - Strategic Coordination, Development & Control
		4.3 Real Property Lifecycle	4.3.1 Real Property - Portfolio Management
			4.3.2 Real Property - Acquisition
			4.3.3 Real Property - Divestment & Disposal
			4.3.4 Real Property - Operations, Maintenance & Repair
			4.3.5 Real Property - Environment & Remediation
			4.3.6 Real Property - Strategic Coordination, Development & Control
		4.4 Information Systems Lifecycle	4.4.1 Info Systems - Portfolio Management
			4.4.2 Info Systems - Acquisition, Development & Deployment
			4.4.3 Info Systems - System Management & User Support
			4.4.4 Info Systems - Strategic Coordination, Development & Control
	5.0 Defence Capability Development & Research	5.1 Capability Design, Development & Integration	5.1.1 Capability Design & Management
			5.1.2 Concept, Doctrine Development & Warfare Experimentation
			5.1.3 Science & Systems Development & Integration
		5.2 Strategic Direction & Planning Support	5.2.1 Strategic Capability Planning Support
			5.2.2 Strategic Force Posture Planning Support
	6.0 Internal Services	6.1 Management & Oversight	
		6.2 Communications	
		6.3 Legal Services	
		6.4 Human Resources Management	
		6.5 Financial Management	
		6.6 Information Management	
		6.7 Information Technology	
		6.8 Real Property	
		6.9 Material	
		6.10 Acquisition	