





## Reinventing the Wheel? Succeeding at Canadian Army Capability Development in the Information Age

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# JCSP 47

## **Master of Defence Studies**

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# Canada

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## MASTER OF DEFENCE STUDIES – MAÎTRISE EN ÉTUDES DE LA DÉFENSE

## REINVENTING THE WHEEL? SUCCEEDING AT CANADIAN ARMY CAPABILITY DEVELOPMENT IN THE INFORMATION AGE

By Major H. Han

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#### ABSTRACT

Canadian military procurement is described as slow, inefficient and wasteful. Governmental review of the process has indicated that military procurement suffers from slow decision-making processes, unclear departmental accountability, ineffective tools for procurement staff and capability requirements that the public or defence industry find difficult to understand.<sup>1</sup> This paper argues that Canadian Army (CA) procurement suffers from inefficient capability development planning vice poor procurement processes and offers a number of recommendations to improve the process.

This paper will substantiate its recommendations by examining the current process and justifying new organizational structures that will improve planning capacity to meet the CA's desired "system of systems" force.<sup>2</sup> As well, the paper will discuss new processes and technologies in order to improve workflow within the Canadian procurement and governance context. Using deductive analysis, the paper will demonstrate that it is possible to improve the capability development process and thereby move more capability development projects into implementation with the CA's limited number of staff in a sustainable manner.

The results of the analysis demonstrate that improving the composition and depth of the capability development staff capacity by grouping more projects together would improve corporate knowledge and resource planning. As well, increased use of a resource allocation framework and improved planning tools would improve organizational agility and allow the CA

<sup>&</sup>lt;sup>1</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC National Printing Bureau), 13.

<sup>&</sup>lt;sup>2</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 3.

to move more projects into implementation. Finally, the paper will make recommendations on how institutionalize this approach.

### REINVENTING THE WHEEL? SUCCEEDING AT CANADIAN ARMY CAPABILITY DEVELOPMENT IN THE INFORMATION AGE

#### **INTRODUCTION**

When one reads modern commentary about Canadian military procurement, they will invariably read about how "terrible" <sup>3</sup> Canada is at buying new equipment or that Canada's process is controversial and lengthy in an effort to fulfil economic goals.<sup>4</sup> While there is merit to the constant criticism of Canadian military procurement, it usually leads to governmental reviews<sup>5</sup>, changes to an already complex procurement strategy<sup>6</sup> and more regulatory bodies (i.e. Independent Review Panel for Defence Acquisition - IRPDA) in an effort to "streamline process".<sup>7</sup> This leads to further delays as procurement specialists and project governance bodies relearn process and slowly continue to advance projects. What does not change in the new "streamlined" approach is faster delivery of modern military capability<sup>8</sup> and, in some cases, the inability to spend all of the allocated defence budget.<sup>9</sup>

What the new Canadian procurement approach fails to address is the rapidly evolving world of military capability. Military systems have become increasingly more complex in design, features and function. Tied to this evolution is the rapid rise of embedded information technology (IT) and the increased integration of technology. As such, new major military

<sup>&</sup>lt;sup>3</sup> Matt Gurney, "Matt Gurney: Supporting local industry shouldn't be the first consideration in military procurement." *National Post.* Postmedia, 2020.

<sup>&</sup>lt;sup>4</sup> David Pugliese, "'Too much noise' on Canadian warship program - DND Deputy Minister admonishes industry executives," *Ottawa Citizen*. Postmedia, 2020.

<sup>&</sup>lt;sup>5</sup> Tom Jenkins, Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities Report of the Special Adviser to the Minister of Public Works and Government Services (Gatineau, QC; National Printing Bureau; 2013).

<sup>&</sup>lt;sup>6</sup> Department of National Defence. *Project Approval Directive v1.1* (Gatineau, QC; National Printing Bureau, 2019).

<sup>&</sup>lt;sup>7</sup> Ibid., 366.

<sup>&</sup>lt;sup>8</sup> Lee Berthiaume "More than 100 military procurements facing delays: Defence Department" CTV News. February 5, 2020

<sup>&</sup>lt;sup>9</sup> Murray Brewster, "DND unable to spend billions in equipment funds, pushing projects beyond next election." *CBC News*, May 30, 2018. https://www.cbc.ca/news/politics/sajjan-dnd-equipment-funds-1.4683606.

capabilities are expected to arrive integrated into the larger information-based "system of systems". In an unusual role reversal, the military is no longer leading technological innovation and the rise of new and emerging dual-use technologies<sup>10</sup> is pressuring the CAF to understand and force employ these new technologies effectively. Although the military procurement process has evolved with the release of the Project Approval Directive (PAD) 2019, the capability-based planning process has not adapted to meet the challenges of procuring modern military systems. While Canadian military procurement is complex,<sup>11</sup> the primary issue related to military procurement is not a result of the procurement process. This paper argues that if the Canadian Army (CA) were to evolve its capability development process, it would be better positioned to design and purchase new modern military capability even within the DND/CAF procurement framework. This will be explained by first examining the current defence capability development procurement (DCDP) program and determining if the DND/CAF project management process limits military procurement. The paper will then explain what the current issues are regarding modern military capability. It will then explain how the DND/CAF can navigate the current processes to efficiently design and articulate operational requirements. Finally, the paper will explore a number of capability development strategies to provide recommendations on how the DND/CAF could design and procure military capability that meets the CA's vision of a technologically advanced and integrated force while still satisfying the political and economic desires of the Government of Canada (GoC).

<sup>&</sup>lt;sup>10</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 41.

<sup>&</sup>lt;sup>11</sup> Ibid., 74.

#### **DND/CAF** Political and Financial Framework

As a nation, Canada allocates a significant amount of money to defence spending. According to the GOC, the DND/CAF spent approximately \$21.9 billion dollars in fiscal year (FY) 2020/21<sup>12</sup> and intends to increase spending up to \$32.7 B dollars by 2026/27. The overarching defence policy and spending plan is captured within *Strong, Secure, Engaged: Canada's Defence Policy*<sup>13</sup>(SSE) and it is further detailed within the *Defence Investment Plan* 2018: Ensuring the Canadian Armed Forces is well-equipped and well-supported (DIP 2018) and *Defence Investment Plan 2018: Ensuring the Canadian Armed Forces is well-equipped and well-supported (Annual Update 2019)* (DIP 2019). These three documents provide the missions, desired military capabilities and overall vision for the DND/CAF.

It is important to note that funding still represents a major resource constraint to force development. While the military budget may seem substantial, only a small percentage of the department's spending is on capital procurement, ~\$3.8B in Fiscal Year 2019/2020<sup>14</sup> DND/CAF manages this capital investment in a 20-year spending program known as the Capital Investment Fund (CIF) which expects to spend \$108B over the next two decades.<sup>15</sup> While this spending plan allows the department to spend money in a predictable manner, it also requires significant management effort to synchronize and can introduce additional delay if major capital projects cannot deliver in their forecasted year. These delays occur as financial offsets must be found before project schedules can be changed. While these administrative delays can be a burden to

<sup>&</sup>lt;sup>12</sup> Department of National Defence, *Defence Budget*. https://www.canada.ca/en/department-national-defence/corporate/reports-publications/transition-materials/defence-101/2020/03/defence-101/defence-budget.html.

<sup>&</sup>lt;sup>13</sup> Department of National Defence, *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau, 2017), 13.

<sup>&</sup>lt;sup>14</sup> Department of National Defence, *Defence Budget*. https://www.canada.ca/en/department-nationaldefence/corporate/reports-publications/transition-materials/defence-101/2020/03/defence-101/defence-budget.html

<sup>&</sup>lt;sup>15</sup> Department of National Defence. *Defence Investment Plan 2018: Ensuring the Canadian Armed Forces is well-equipped and well-supported.* (Gatineau, QC; National Printing Bureau, 2018), 9-10.

project teams to navigate, the investment plan itself is not the primary cause for delays in delivering military capability.

Within this financial and political framework, the DND/CAF utilizes the Defence Capability Development Program (DCDP) to govern capability development for the CAF.<sup>16</sup> DCDP describes the roles that each GoC department plays, as well as the DND/CAF interdepartmental roles with regards to capability development and procurement. The DCDP also links DND/CAF capabilities to meet the GoC's defence objectives utilizing Capability Based Planning (CBP). CBP focuses on meeting CAF/DND missions through a deliberate process of identifying capability gaps and surpluses to ascertain future force requirements.<sup>17</sup> CBP is conducted in three-year cycles, working backwards to achieve results which will lead to a *bottom-up developed* and *top-down driven* force development process.<sup>18</sup> This process, as shown in Figure 1, is a lengthy but important process as it provides the necessary analysis to determine which capabilities will be procured to support SSE.

<sup>&</sup>lt;sup>16</sup> Department of National Defence. *Evaluation of the Defence Capability Development Program*. Evaluation of Defence Capability Development Program - Canada.ca. (Gatineau, QC; National Printing Bureau, 2017).

<sup>&</sup>lt;sup>17</sup> Chief Force Development. *Capability Based Planning Handbook*. (Gatineau, QC: National Printing Bureau; 2019), 2-5.

<sup>&</sup>lt;sup>18</sup> Department of National Defence. Evaluation of the Defence Capability Development Program. Evaluation of Defence Capability Development Program - Canada.ca. (Gatineau, QC; National Printing Bureau, 2017).



#### **Capability Based Planning**

Figure 1 – CAF Capability Based Planning

Source: Chief Force Development. *Capability Based Planning Handbook*. (Gatineau, QC: National Printing Bureau; 2019), 4.

As part of the DCDP, procurement specialists work with the capability development team to identify equipment, training and infrastructure that need to be procured to support the new capability. In the DND/CAF model, the two halves of capability development and procurement process are described as the Project Sponsor (Sponsor) and Project Implementer (Implementer). The sponsor, normally the CAF elements, is recipient of the procured capability and defines the operational requirements for a given capability. The implementer, normally Assistant Deputy Ministers (ADM) Material (Mat) or ADM Information Management (IM), is responsible for defining and implementing the solution.<sup>19</sup> These two halves ensure that there are checks and

<sup>&</sup>lt;sup>19</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 50.

balances to departmental procurement and form the DND/CAF project team for major capital procurement. Other key players that are also involved in the CBP process from DND/CAF are ADM Science and Technology (S&T), ADM Finance (Fin) and Vice Chief of the Defence Staff (VCDS). These organizations support, provide oversight and specialist advice throughout the CBP process.

Beyond the CAF/DND players, two other departments play a major role in Canadian defence procurement. They are Public Services and Procurement Canada (PSPC) and Innovation, Science and Economic Development Canada (ISED).<sup>20</sup> PSPC ensures that governmental procurement is conducted in an open, transparent and fair manner, while still meeting federal needs.<sup>21</sup> ISED aligns federal procurement with the GoC's wider economic goals and works to ensure that federal procurement aligns with its economic development plan.<sup>22</sup> These departments work with DND/CAF to advance projects for approval to either the Minister of National Defence (MND) or Treasury Board (TB) for approval. While it may appear that there are too many players in defence procurement, utilizing such a comprehensive team ensures that defence spending is conducted in a defensible and transparent manner.

As DND/CAF is the largest GoC department, defence spending represents the greatest amount of discretionary spending that the GOC undertakes annually. Invariably, this means that large military procurement decisions become very political as the government naturally wants to leverage defence spending to promote Canadian industry and economic aims.<sup>23</sup> This paper will

<sup>&</sup>lt;sup>20</sup> Department of National Defence. Project Approval Directive v1.1. (Gatineau, QC; National Printing Bureau, 2019), 266.

<sup>&</sup>lt;sup>21</sup> Public Services and Procurement Canada. "*Our mission, vision and values*". (17 November 2019). https://www.tpsgc-pwgsc.gc.ca/apropos-about/mvv-mvv-eng.html.

<sup>&</sup>lt;sup>22</sup> Innovation, Science and Economic Development Canada. *Innovation, Science and Economic Development Canada*. (15 February 2021). https://www.ic.gc.ca/eic/site/icgc.nsf/eng/home.

<sup>&</sup>lt;sup>23</sup> Phillip Lagasse. "Holding Canadian Governments to Account for National Defence.". In P. L. Edited by Thomas Juneau, *Canadian Defence Policy in Theory and Practice* (pp. 45-61). (Cham, Switzerland: Palgrave Macmillan; 2020), 46.

not discuss the validity of this approach as this is purely a political consideration and beyond the realm of the DND/CAF to change. <sup>24</sup> However, understanding the governmental framework and its impact on the procurement process is important in order to develop successful procurement strategies as it is not possible to just ignore the influence it has over the military procurement process. As such, accepting these constraints allows the author to focus on the DCDP and not bog down in debating procurement delays that result from political conflicts such as the recent trade conflict between GoC and Boeing.<sup>25</sup>

#### Defence Capability Development Program (DCDP) and the CAF

In Canada, the DCDP places heavy emphasis on CBP as this approach is widely used by Canada's allies. While CBP is a relatively new process, being introduced into Western doctrine in the early 2000s by the RAND corporation,<sup>26</sup> it was being examined by Canadian planners in the early 1990s. In 1996 after a series of working groups, the DND/CAF released its force planning scenarios to guide CAF capability development. The document outlined thirty-one operational tasks within twelve force planning scenarios.<sup>27</sup> This approach was useful to military planners in bounding the force planning problem space and working on strategies to counter future threats.

<sup>&</sup>lt;sup>24</sup> It is important to note that, while there are superior governmental structures, like Australia's "One Defence" business model, this approach is not implementable by the DND/CAF as this would mean a realignment of other governmental departments. Although it could be argued that Australia and Canada share many similarities, Australia's security situation is significantly different from Canada's. As such, convincing the GoC to change its approach in a low security risk environment is near-impossible and difficult to justify as the DND/CAF has shown that it is more than capable of procuring material in high intensity conflicts through the UOR process. Department of Defence. *Defence Capability Manual*. (Canberra, Australia: Defence Publishing, Library and Information Service; December 2020).

<sup>&</sup>lt;sup>25</sup> Boeing filed a trade complaint regarding the GoC's support of Bombardier and their C-Series airliners citing unfair trade practices. As a result, the GoC retaliated by delaying its procurement of various Boeing military systems such as Blackjack SUAS and threatened to cease all procurements from Boeing. Rob Gillies. "Trudeau: Canada could stop dealing with Boeing over dispute." *Defence News*. 18 September 2017.

<sup>&</sup>lt;sup>26</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (RAND Corporation; 2002).

<sup>&</sup>lt;sup>27</sup> A. Bradfield, G.L. Christopher, D. Maclean. Department of National Defence. *The Development of a Scenario Set for Departmental Force Planning*. (Ottawa, ON; November 1998), 7.

CBP has proven to be a more flexible approach to military capability development than the "threat-based" defence planning previously used by Western militaries and is considered the "gold standard for defence planning."<sup>28</sup> Figure 2 shows the CBP process which Canada mostly follows:



Figure 2 – Capability Based Planning Process

Source: Paul K. Davis, Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation, (Santa Monica, CA; RAND Corporation, 2002), 12.

This approach allows the DND/CAF to build capabilities that the government can utilize to reach its strategic goals, substantiates resource allocation and defines a strategy to achieve clear military goals. Where the Canadian model differs is at Step 4 – Analytical assessments under

<sup>&</sup>lt;sup>28</sup> Stephan De Spiegeleire, "Ten Trends in Capability Planning for Defence and Security," *The RUSI Journal* 156, no. 5 (2011): 20-28.

Uncertainty. At this phase according to Davis, senior leadership should provide guidance and intent for prioritization of capabilities and link this to resource, ideally in a Resource Allocation Framework (RAF).<sup>29</sup> In the Canadian model, this justification is missing and capabilities are merely listed in the CIF. While this is an excellent process, there is a heavy staff requirement to build capability options as it requires significant analysis to make concrete military capabilities from an abstract strategic vision. In 2005, the DND/CAF updated to the second generation of force development and continues to operate CBP to the present era.<sup>30</sup>

#### **Capability Development in the Canadian Army**

The process of capability development is described differently by each CAF element but within the CA it is described in four stages: Conceive, Design, Build, and Manage.<sup>31</sup> These four steps are also synchronized with the DND's procurement steps of: Identification, Options Analysis, Definition, Implementation and Project Closeout.<sup>32</sup> Figure 3 illustrates the CA approach to capability development. It is important to note that military capability is a composition of people, equipment, training and doctrine brought together to deliver desired results and not just equipment.

<sup>&</sup>lt;sup>29</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (Santa Monica, CA; RAND Corporation; 2002), 36.

<sup>&</sup>lt;sup>30</sup> M. Rempel. An overview of the Canadian Forces' Second Generation Capability-Based Planning Analytical Process. (Ottawa, ON: Defence Research and Development Canada Centre of Operational Research; 2010), 3-6.

<sup>&</sup>lt;sup>31</sup> Canadian Army Staff, Army Governance, PowerPoint briefing, 1 August 2015, slide 10.

<sup>&</sup>lt;sup>32</sup> Department of National Defence. *Project Approval Directive v1.1*. (National Printing Bureau; Gatineau, QC, 2019) 32.



Figure 3 – Army Capability Development Continuum

Source: Canadian Army Staff, Army Governance, PowerPoint briefing, 1 August 2015, slide 10.

Within the CA, capability development is managed by Chief of Staff Army Strategy (COS A Strat) with responsibilities being spread out amongst its many directorates. As shown in Figure 3, the key directorates that lead the process are the Canadian Army Land Warfare Centre (CALWC) and Director Land Force Development (DLFD).<sup>33</sup> While CALWC and DLFD lead capability development, they are supported by many other directorates such as Director Land Requirements (DLR), Director Land Infrastructure (DLI), Director Land Command Information

<sup>&</sup>lt;sup>33</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 60.

(DLCI), and Canadian Army Doctrine and Training Centre (CADTC) to name a few. Another important player within capability development, is the Corps/Branch (i.e. Artillery, Armoured, etc). Each Corps/Branch Director provides guidance on capability development and participates in the force development process as a level of approval before COS A Strat. The role each Corps/Branch plays in capability development cannot be understated. As an example, DLR is staffed in a manner that is broken up by Corps/Branch (i.e. DLR 3 – Armoured, DLR 7 – Logistics, etc) and DLR staff tend to work on projects in silos based on their respective Corps vice working in a pan-army approach. To illustrate the CA capability development process, a short description of each stage is provided to frame the process and should be read in conjunction with Figure 3. Understanding the current process is important because it informs the reasoning on proposed optimization to CA capability development.

#### Conceive

During the Conceive phase, Canadian Forces Intelligence Command (CFINTCOM), describes the future security environment (FSE). The FSE is a prediction that describes the security challenges that DND/CAF can expect to face in future conflicts. The FSE is an important part of the capability development process as it helps bound the problem space for military planners. While this may appear to be similar to "threat-based" planning, the key difference is that CBP does not focus on specific enemies or events to shape military planning but rather the capabilities that the military wishes to employ to execute its strategy during a particular mission.<sup>34</sup> CALWC then develops an operating concept for the CA that allows the CA to execute its assigned missions in the FSE.<sup>35</sup> This operating concept is then approved by the

<sup>&</sup>lt;sup>34</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (RAND Corporation, 2002), 8-9.

<sup>&</sup>lt;sup>35</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 59-60.

Commander CA (CCA) and published as a reference for the supporting staff (i.e. DLR, DLI, CADTC, etc) to use in the force development process. Currently, the operating concept for the CA is *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations* (CE).<sup>36</sup>

From the operating concept, CALWC and the supporting directorates compare the portfolio of CAF capabilities to determine if the existing force can conduct the envisioned operations. If the force cannot a capability gap is identified. The identified capability gap is then studied to determine the operational requirements to fill the gap. These gaps can be filled in a number of ways. In some cases, delivering new training to the existing force will remedy the issue but, in other cases, it could require the procurement of major pieces of equipment, new training and doctrine. Ultimately, this gap analysis results in a number of courses of action (COA) to fill the capability gap.

These COAs are then examined through a Personnel and Leadership; Research and Development, and Operational Research and Analysis (plus Experimentation); Infrastructure, Environment and Organization; Concepts and Doctrine; Information Management and Technology; Equipment and Support; and Generate (PRICIE+G) analysis framework.<sup>37</sup> This analysis seeks to determine what resources are required to create each capability option. Concurrently, the priorities for research and development are given to ADM(S&T) to stimulate scientific research and ensure that the new capability is scientifically sound. This work culminates with the creation of the Strategic Context Document (SCD) which provides the

<sup>&</sup>lt;sup>36</sup>Department of National Defence. *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations*. (Kingston, ON; Army Publishing Office).

<sup>&</sup>lt;sup>37</sup> Emile Pelletier. Operational research and analysis supporting Canadian Army PRICIE+G analyses: A planning and collaboration tool. Defence Research and Development Canada. (Ottawa, ON; Minister of National Defence, 2016), 1.

business need and desired outcomes.<sup>38</sup> The SCD is approved at the Defence Capability Board (DCB), the CAF approval body with the capability teams being authorized to design solutions. **Design** 

At the design phase, CALWC then refines the initial force development options. The initial COAs are analyzed against the force planning scenarios, ideally in a synthetic environment. The results of the analysis are compared to the after-action reviews from the Army Lessons Learned Centre and allied capabilities to ensure alignment with current operational capabilities which further refines the possible COAs. The updated COAs undergo another PRICIE+G analysis to better define the operational requirements and required resources such as upgraded or new equipment, training or infrastructure to support the new capability. This work is brought together into a number of formal options and identifies the rough order of magnitude (ROM) cost as well as each project's complexity and risk which are compared in a matrix. These options are then presented to DCB within a Business Case Analysis (BCA) for decision. Once DCB selects an option, it is prepared with indicative cost for review by Programme Management Board (PMB). PMB is the departmental approval body that allows DND/CAF to expend capital funds to advance major capital projects. This approval, also known as Project Approval (PA) Definition, allows the project team to refine the requirements (i.e. quantity, performance, etc) of the desired capability. It is also at this point that CALWC hands the capability design to DLFD to build.

#### Build

During the Build phase, DLF finalizes the force structure. They lead the development of doctrine, training competencies and standards, and the delivery of procured equipment which is

<sup>&</sup>lt;sup>38</sup> Department of National Defence. *Project Approval Directive v1.1.* (National Printing Bureau; Gatineau, QC, 2019), 33.

captured within a Master Implementation Directive (MID). The MID synchronizes the required activities to create the initial cohort of capability which typically includes the running of initial cadre training, user trials for the procured equipment and the establishment of the conditions for both initial and final operational capability (IOC and FOC).<sup>39</sup> Once the new capability is integrated into the field force, the capability development team then commences project closeout and handover of the capability to the continental staff for management.

#### Manage

In the Manage phase, DLFD hands responsibility of the new capability to the continental staff. This normally occurs after FOC; however, handover is decided by COS A Strat and Chief of Staff Army Operations (COS A Ops). Once the capability is handed over, COS A Ops manages the force generation and deployment of the new capability on operations. Throughout this phase, the capability is refined and improved with feedback from the user community. Periodically, there could be minor capability upgrades; however, in some cases such as the LAV 3, there could be significant system upgrades or replacement.

It is also important to note that there is an ability in the CBP process to quickly generate new capabilities that were not foreseen by the military planners in the Conceive phase. This process is known as the Urgent Operational Requirements (UOR) process<sup>40</sup> whereby the force can quickly procure equipment and training. This is normally done by the COS A Strat, in coordination with COS A Ops with direction from CCA. This process is not considered the ideal process because it is generally more costly to procure UOR capabilities in the long term but it provides great flexibility to the CAF.

<sup>39</sup> Ibid., 210.

<sup>&</sup>lt;sup>40</sup> Ibid., 43

#### **Defence Procurement and Project Approval Directive 2019**

During the capability development process, there may be a requirement for the procurement of costly pieces of equipment which is defined as anything greater than \$10M.<sup>41</sup> Treasury Board governs DND/CAF spending in order to keep governmental spending both transparent and fair; however, this also makes governmental spending complicated and very bureaucratic. Treasury Board manages governmental procurement through the *Policy on the Planning and Management of Investments*<sup>42</sup> and *Directive on the Management of Projects and Programmes*,<sup>43</sup> which is clarified through the DND/CAF produced PAD. The PAD exists to guide project staff in moving major capital projects through this complex process and it is the primary reference for CA equipment procurement teams.

This directive also outlines a number of methodologies to advance projects based on the nature of their deliverables; however, the general approach to major capital projects is a five-step process of: Identification (ID), Options Analysis (OA), Definition (Def), Implementation (Imp) and Close Out (CO). These steps are led by two main parties: the project sponsor which is normally within the CAF and the project implementor which is typically from DND, usually being ADM (Mat). Depending on the project phase, either the sponsor (ID and OA) or implementor (Def, Imp and CO) is the lead for the activities with PSPC and ISED representation when a project enters OA as shown in Figure 4.

<sup>&</sup>lt;sup>41</sup> Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC; National Printing Bureau, 2019), 142.

<sup>&</sup>lt;sup>42</sup> Government of Canada. *Policy on the Planning and Management of Investments*. (Ottawa, ON; 11 Apr 2019) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32593

<sup>&</sup>lt;sup>43</sup> Government of Canada. *Directive on the Management of Projects and Programmes*. (Ottawa, ON; 11 Apr 2019) https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32594



Figure 4 – Capability Development Life Cycle

Source: Department of National Defence. *Project Approval Directive v1.1.* (National Printing Bureau, Gatineau, QC, 2019). 3. In 2019, the PAD was updated to address the issues identified in SSE to improve the speed of military procurement. While authorities and procurement process were clarified, it has not changed the original project steps (i.e. ID, OA, etc) and timelines for advancing projects and has, in effect, added time to procurement with the addition of a new gateway body such as IRPDA.<sup>44</sup> Although it may appear that the delaying culprit to military procurement lies with the

procurement process, this is not necessarily the case as there are many different project

approaches that CA can use to procure a new capability.

#### **Project Approaches**

The PAD offers project teams various approaches to delivering new capabilities. These project types are as follows:<sup>45</sup>

<sup>&</sup>lt;sup>44</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 269.

<sup>&</sup>lt;sup>45</sup> Ibid., 41.

- Standard or "Waterfall" Project the most common type of project, it encompasses the standard five-step process and is typically used for traditional military projects;
- Phased Project A project where the overall capability is delivered in phases over time to better define deliverables and manage risk;
- Cyclical Project A project where multiple levels of capability are delivered with later levels delivering improved capability based on previous deliverables. This type of project is well suited to IT/IM projects;
- Minor Project Projects that are low dollar value (<\$10M dollars) that are typically low complexity and risk;
- 5.) Urgent Operational Requirements Rapidly developed projects that are required to deal with operational emergencies. It is well suited to delivering capability in short timeframes to deal with specific operational problems;
- 6.) Programme Approach– Formerly known as omni-bus projects, it is used to deliver a number of dependent projects under the same project and allows for projects with similar High Level Mandatory Requirements (HLMRs) to deliver constituents capabilities, that would warrant their own project, as part of a larger project;
- 7.) Program Approach A mechanism for DND to deliver enduring components of the Defence Services Programme (DSP) that have no clear end-date. It falls under the oversight of the Programme Management Board (PMB) and is funded through a business planning process; and

8.) Portfolios – The portfolio approach is a streamlined process suitable for low complexity and risks projects. These smaller projects are grouped and managed collectively to meet specific needs.

Unfortunately, when CA projects are identified they inevitably tend to look to the standard "waterfall" approach as the mainstay for capability delivery. The important step of project planning is frequently rushed in an effort to advance capability development quickly. Typically, this is the result of inexperienced project teams and a desire to advance projects quickly. This issue is also aggravated by the frequent turnover of the military personnel and the loss of corporate knowledge. As the military is responsible for initiating capability development and project design, this critical phase will frequently be initiated by untrained staff.

Sometimes a project will transition over from one project delivery type to another but moving to the right project type can create delays as significant change in project delivery or costs must be approved by the Capital Investment Fund Change Proposal (CIFCP) process.<sup>46</sup> As shown from the PAD, there are a number of project approaches that could be employed to provide a steady stream of new equipment and selecting the right project approach can provide both depth and flexibility to the military procurement process.

#### **ISSUES WITH CANADIAN ARMY PROCUREMENT**

SSE describes a number of military procurement issues within DND/CAF. It outlines that only 70 percent of major capital projects are delivered on time and that four issues are causing delays. These are cumbersome decision-making processes, unclear or diffuse departmental accountability, lack of education or tools for procurement staff and capability requirements that the public or defence industry find difficult to understand.<sup>47</sup> While this analysis is not completely wrong, it plays into the stereotype of governmental incompetence which is not the case. Canada has proven that it can procure and deliver military capability quickly when required.

During Canada's 13-year mission to Afghanistan,<sup>48</sup> Canada purchased and fielded numerous new systems such as the M777 howitzer, Leopard 2 tanks, CH-47 Chinook helicopters and many other important pieces of equipment that provide the CAF with a combat advantage over their adversaries. If military procurement was so "broken"<sup>49</sup> how was Canada able to purchase and field new equipment so quickly and efficiently? The answer lies within the Office of the Auditor General (OAG) and its 2009 report<sup>50</sup> "Chapter 5 - Acquiring Military Vehicles for Use in Afghanistan". The OAG audited the procurement of 4 armoured vehicles and it observed that while DND/CAF procured the vehicles in accordance with Treasury Board (TB) policy, it had not followed its own PAD and, specifically, that the four audited projects did not follow the traditional steps of capability development. What is telling is that when capability gaps and

<sup>&</sup>lt;sup>47</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC National Printing Bureau), 13.

<sup>&</sup>lt;sup>48</sup> Government of Canada. "*Canada in Afghanistan (2001-2014)*" Canada in Afghanistan (2001-2014) - Canada.ca. 29 June 2020.

<sup>&</sup>lt;sup>49</sup> Richard Shimooka. "Canada has the worst Military Procurement System in the Western World." *MLI: The True North in Canadian Public Policy*. (21 January 2019) https://www.macdonaldlaurier.ca/canada-worst-military-procurement-system-shimooka-the-hill-times/.

<sup>&</sup>lt;sup>50</sup> Office of the Auditor General. "Chapter 5 – Acquiring Military Vehicles for Use in Afghanistan." 2009 Fall Report of the Auditor General of Canada. (Gatineau, QC; National Printing Bureau).

threats are clear, procurement is able to quickly deliver equipment which undermines the argument that Canadian procurement is inherently broken.<sup>51</sup>

When one unpacks Canadian military procurement issues, it becomes evident that the issues transcend the decision-making process or unclear departmental responsibilities and aligns more with the last observation within SSE. Namely that capability requirements are difficult for the public or military industry to understand. This issue exists not because military staff do not understand military requirements but because the military capability the government envisions is incredibly complex to design. SSE's direction that the CAF must provide a force that can "anticipate, adapt and act"<sup>52</sup> would be simple to create if the missions were also simple; however, the CAF is mandated to conduct missions that are mutually exclusive. Thus, to meet the GoC's mandate, the CAF describes a bewildering number of requirements that defence industry finds difficult to understand<sup>53</sup> in an effort to build the integrated and general-purpose force envisioned by SSE.<sup>54</sup>

<sup>&</sup>lt;sup>51</sup> Office of the Auditor General. "Chapter 5 – Acquiring Military Vehicles for Use in Afghanistan." 2009 Fall Report of the Auditor General of Canada. (Gatineau, QC; National Printing Bureau), Section 5. 20.

<sup>&</sup>lt;sup>52</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 63.

<sup>&</sup>lt;sup>53</sup> Defence forces are increasingly being asked to conduct multi-spectrum operations so their structures must be flexible enough to change amongst multiple mission sets. As such, the defence community is trying to optimize capabilities to provide diverse/dual capabilities. Invariably, this constitutes some form of trade off (i.e. speed vs protection) to deliver the desired results. These conflicting requirements make it difficult to describe to defence industry and measure for performance. Richard Hooke. "The Defence Industry in the 21<sup>st</sup> Century". *PricewaterhouseCoopers*. (https://www.pwc.pl/en/publikacje/defence industry ads.pdf; 2005), 19.

<sup>&</sup>lt;sup>54</sup> Tom Jenkins. Canada First: Leveraging Defence Procurement Through Key Industrial Capabilities Report of the Special Adviser to the Minister of Public Works and Government Services. (Gatineau, QC; National Printing Bureau, 2013), 22.

#### Why are CA operational requirements difficult to understand?

Designing an integrated general-purpose force is no mean feat because the DND/CAF have a wide range of missions it must be able to conduct. The CAF's eight core missions<sup>55</sup> are:

- 1.) Detect, deter and defend against threats to or attacks on Canada;
- Detect, deter and defend against threats to or attacks on North America in partnership with the United States, including through NORAD;
- Lead and/or contribute forces to NATO and coalition efforts to deter and defeat adversaries, including terrorists, to support global stability;
- Lead and/or contribute to international peace operations and stabilization missions with the United Nations, NATO and other multilateral partners;
- Engage in capacity building to support the security of other nations and their ability to contribute to security abroad;
- 6.) Provide assistance to civil authorities and law enforcement, including counterterrorism, in support of national security and the security of Canadians abroad;
- Provide assistance to civil authorities and non-governmental partners in responding to international and domestic disasters or major emergencies; and
- 8.) Conduct search and rescue (SAR) operations.

These mission sets are both diverse and complicated and encompass a myriad of operational tasks which makes force design difficult.<sup>56</sup> While defending Canada is the traditional role of the CAF, missions five, six, seven and eight complicate force development especially for the CA. A force that is capable of conducting warfighting, peace support operations (PSO) and

<sup>&</sup>lt;sup>55</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 82.

<sup>&</sup>lt;sup>56</sup> A. Bradfield, G.L. Christopher, D. Maclean. Department of National Defence. *The Development of a Scenario Set for Departmental Force Planning*. (Ottawa, ON; November 1998), 5-9.

aid to civil power is neither simple to develop or equip. As such, more work is required in the design portion to successfully train, equip and execute these tasks. Confounding this issue is that there are significant resource constraints to delivering such a force and it is not possible to just layer more capability onto the CA in one fell swoop to build the idealized force model so obsolescence management and personnel limitations must be considered in force design.

Tied to the issue of describing a multi-purpose or general force is the challenge of IT to support force integration. Layering the requirement for high levels of IT on the envisioned military capability to create a "system of systems" also presents a new pressure on the limited resources allocated to military procurement. Ultimately, this all results in a laundry list of operational requirements for a given capability that is difficult to understand because project teams are not able to easily prioritize or make good recommendations on where the trade-offs must be made.

#### Is Integrated IT and Adaptable Forces a Bona-Fide Requirement?

Notwithstanding governmental direction,<sup>57</sup> some Canadians would argue that the CAF does not require a digitally integrated, modern force and that defence savings could be used on other governmental policies<sup>58</sup> but overhauling IT and creating an adaptable force represents significant savings as dual-purpose forces provide more capability with residual increases in cost. Originally, IT was restricted to traditional computer and communication systems but it is now appearing across many military capabilities such as soldier-level computing devices (i.e. Personal Digital Assistants), armoured fighting vehicle sub-systems (i.e. onboard cameras, GPS and lasers) and even artillery howitzers (i.e. Gun Laying and Positioning systems). Along with

<sup>&</sup>lt;sup>57</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 15.

<sup>&</sup>lt;sup>58</sup> Scott Gilmore. "We've given up on Canada's military, so let's abandon it altogether." *Macleans*. January 29, 2018.

"smarter" pieces of equipment, technology has also advanced significantly in the realm of integration. Military capabilities that were originally linked via liaison officers are becoming replaced with new systems utilizing digital linkages to share information. This wider integration has dramatically improved accessibility of information across multiple systems and has dramatically improved modern military capability by allowing military forces to operate in a more informed and networked fashion.

The advances of IT have led to new military operational requirements where IT capabilities need to be integrated into military capability at the conceptual design stage. Jon Lindsay, a professor in Political Science and Public Policy, describes this new military IT capability in his "Technology Theory of War". He describes how "smaller yet smarter forces can identify and prosecute targets more quickly and thereby defeat larger but slower enemies."<sup>59</sup> This theory explains why many modern militaries are investing in integrated IT military capabilities vice "dumb" military capabilities that can only operate alone. As backbone IT technology has become quick, accurate and reliable, modern military future concepts are evolving to incorporate these ideas into future force structures.<sup>60</sup> This approach has translated into "intelligence-led" <sup>61</sup> and "network-enabled"<sup>62</sup> forces in modern operations and makes integrated forces a bona fide military requirement.

#### What issues do IT bring to Military Capability Design?

While IT brings greater capability to the military, it has also introduced significant challenges to modern day procurement. Namely, IT requires frequent software updates or regular

<sup>&</sup>lt;sup>59</sup> Jon R. Lindsay. Information Technology and Military Power. (Cornell University Press, 2020), 13.

<sup>&</sup>lt;sup>60</sup> Gina and Linda Baker Hagler. *The Evolution of Military Technology*. (Chicago, IL: Rosen Publishing Group, 2018), 54-58.

<sup>&</sup>lt;sup>61</sup> Department of National Defence. *Land Operations*. (Kingston, ON; Army Publishing Office. 2007), 7-17/167 - 7-19/167.

<sup>&</sup>lt;sup>62</sup> Department of National Defence. *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations*. (Kingston, ON; Army Publishing Office), 15.

hardware upgrades to maintain a technological edge. Moore's law describes the doubling effect of each generation of computing technology as significant leaps forward with each successive generation.<sup>63</sup> The speed of technological upgrades has created a shortened equipment life-cycle and introduced new pressures on military procurement to maintain an IT edge. SSE identifies this concern as a key security trend in the FSE.<sup>64</sup> As well, networking military capabilities is not a simple matter of plugging systems together, a great deal of work is needed to ensure that the IT systems are capable of operating together in a coherent fashion which can mean IT solutions need to operate at a enterprise level.

In conjunction with the challenge of technological lifecycle management, integration has become increasingly complex. As there is no central governance to the delivery of enterprise level IT solutions, IT considerations are left to the individual project teams to manage. This decentralized approach leads to delays as project teams ascertain future IT requirements through working groups and meetings. Tied to the IT requirements is the problem of IT design. There are numerous competing IT solutions and integration costs can become significantly higher if key IT decisions are undertaken late in a project lifecycle. This inevitably leads to project delays to ensure IT alignment and fiscal manageability, as project teams try to understand the impact of selected IT solutions on other dependent projects.

This delay then cascades into further delays when a new better solution enters the market further disrupting capability design as project teams re-convene to determine if the new solution should be considered, essentially creating an "analysis-paralysis" situation. Ultimately, the decentralized approach to capability development has led to sub-optimal solutions with heavy

<sup>&</sup>lt;sup>63</sup> Mark Lundstrom. "Moore's Law Forever?" *Science (American Association for the Advancement of Science)* 299, no. 5604 (2003), 210-211.

<sup>&</sup>lt;sup>64</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 49.

criticism being leveled against the procurement teams when the new capabilities are delivered with poor integration.

An example of this would be the Medium Range Radar procured by CA.<sup>65</sup> Originally procured as a weapon locating radar (WLR) to support counter-artillery operations, the radar comes equipped with WLR functionality but also possesses other capabilities such as air surveillance for both manned and unmanned aircraft systems (i.e. UAS); however, the radar is only integrated into an artillery network and not into a wider NATO Air Defence network by design. The project team knew<sup>66</sup> that the additional capabilities would be useful but did not have funding or direction to procure the additional capabilities to use the radar within a NATO network. While these types of procurements bring embarrassment to the DND/CAF, they are an inevitable result of stove-piped capability development and limited resources vice a poor procurement process. These IT issues, along with Canadian customizations to military capabilities, are part of the reason why many major capital projects struggle to deliver on time or even in an interoperable fashion as project teams look for direction and guidance to integrate these new capabilities into larger capability design.

#### Is Capability Based Planning the problem?

It may be tempting to declare CBP the culprit and discuss moving back to traditional threat-based planning, but this would be a mistake as the CBP process is a sensible approach to modern military capability development. CBP provides greater flexibility to the government and is proactive in nature. While it is challenging for the military planning process, successfully done

<sup>&</sup>lt;sup>65</sup> National Post. "New Canadian Forces radar worth more than \$200 million can't be linked in with NATO networks / National Post." New Canadian Forces radar worth more than \$200 million can't be linked in with NATO networks | National Post. 16 July 2018.

<sup>&</sup>lt;sup>66</sup> The author was the Canadian Army Project Director for the Medium Range Radar (MRR) sub-project and is familiar with the project decisions that led to MRR being fielded without this network integration.

it provides a sound way forward in force development, especially in a resource-constrained environment.<sup>67</sup> Figure 5 illustrates how the process should work and there are no discernable weaknesses with this approach to military planning except the specifics of how it is implemented.



**Figure 5 – Moving from Need to Capability** 

Source: Paul K. Davis, Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation, (Santa Monica, CA; RAND Corporation, 2002), 9.

<sup>&</sup>lt;sup>67</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (RAND Corporation; 2002), 36.

While the guiding principle of CBP is sound, the challenge is implementing the CA's "system of systems"<sup>68</sup> vision especially within the CAF/DND procurement process. If one examines the Figure 5, it is apparent that the diagram describes individual capabilities and considers the impact of wider military integration (captured as Design Space) as adjunct to the Preliminary Design. The issue with this approach, in the Canadian process, is that Design Space needs to be considered before Preliminary Design because the Canadian procurement is not flexible enough to adapt to major project scope changes in the procurement process. PAD 2019 describes these project constraints as an "Iron Triangle"<sup>69</sup> which is illustrated at Figure 6.



#### **Figure 6 – Project Constraints (Iron Triangle)**

Source: Department of National Defence. *Project Approval Directive v1.1*. (National Printing Bureau, Gatineau, QC, 2019). 34.

<sup>&</sup>lt;sup>68</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 3.

<sup>&</sup>lt;sup>69</sup> Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC;National Printing Bureau, 2019), 34.

The project constraints are made more inflexible by the fact that CIFCP is considered risky as it can mean that a project could be re-programmed in a CIF at a much later date when resources are available. This change could be detrimental to operations as obsolescence remains a constant threat to readiness and operational relevance. While the CIFCP should not matter, it frequently results in the CA attempting to reduce project scope to keep projects moving forward on schedule and within initial budget estimates to ensure the delivery of capability vice pressing for the correct solutions.<sup>70</sup>

To illustrate this point, if one were to look at Figure 3 for the CA's capability development process, the project team is expected to establish the High-Level Mandatory Requirements (HLMR) for a given capability within the Strategic Context Document (SCD) for approval at DCB during "Conceive"; however, the initial force structures are not evaluated until after DCB when the HLMRs are approved in "Design".<sup>71</sup> This approach typically results in a situation where assumptions or misunderstanding regarding a given capability are not identified until after the HLMRs are approved. This situation is problematic as significant changes to capability scope or costs can impact the CIF spending plan. As mentioned previously, unforecasted capability requirements or IT integration can raise costs dramatically and so it places decision-makers in a difficult situation of making trade-offs earlier in the design process than is described in the CBP (Figure 3) in an effort to keep major projects on schedule within the CIF.

Although a CIFCP can be initiated, the CA often chooses to make the trade-offs earlier in an effort to keep its projects on schedule to access the resources of the CIF despite the fact that

<sup>&</sup>lt;sup>70</sup> When the author was in DLR, this approach was called "Procure-to-Budget". While capability development planners were supposed to ignore costs, initial ROM costs were always a topical discussion point for projects as they advanced to DCB and PMB for approval and project teams were expected to consider costs as part of their options.

<sup>&</sup>lt;sup>71</sup> Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC, National Printing Bureau, 2019), 61.

the scope may be significantly reduced. While this approach may get a capability delivered, it will rarely meet all of the operational requirements and usually is delivered with some degree of capability loss. This is because many in the CA believe something is better than getting nothing at all. This zero-sum approach is detrimental to CBP because it creates a situation where an inadequate solution is delivered, and the CA is forced to ask for more funding or another project that will either fix the delivered capability or seek to address the original capability gap appropriately.<sup>72</sup> Neither of these solutions is optimal as it creates questions about DND/CAF competence regarding how they define operational requirements and enable procurement.

While the Canadian procurement process creates pressures within the CBP process, it is not necessarily a procurement solution that will fix the problem of resources and risk. As illustrated earlier, there are multiple project types that can continually deliver capability as long as the supporting projects are designed correctly. What needs to be addressed is minimizing or preventing significant project change<sup>73</sup> between preliminary and final design earlier in the process. Significant projects changes add additional bureaucratic and authoritative review and prevents projects from moving into PA(Def) and PA(Imp) swiftly. These issues can be mitigated if the CA employed a wider capability blueprint.

A blueprint for enterprise-level capabilities would provide the necessary top-down guidance earlier in the CBP process and ensures a common understanding of the desired system interactions to the supporting projects. As well, the blueprint would imbue a high level of standardization and interoperability before preliminary design commences. It is inefficient for

<sup>&</sup>lt;sup>72</sup> An example of this type of procurement mistake would be the Enhanced Position and Locating System Radio (EPLRs) project. Although well intentioned staff procured the capability, technological limitations and resources restricted its wide fielding and actual performance. As such, the CA procured Wave Relay radios and seek to fix many of the issues of EPLRs with the Tactical Communications Modernization project.

<sup>&</sup>lt;sup>73</sup> In the context of Canadian procurement, significant project change is change (i.e. cost or scope change) that forces a project to be reviewed again by the delegated authority through a CIFCP.
project teams to define boundaries between associated capabilities vice being directed on the scope of their projects as well as the HLMRs and working on refining solutions out of this blueprint.

As well, tough decisions need to be made early in the CBP process at the "Preliminary Design and Design Space" phase to keep projects aligned and ensure that resource allocation is defined earlier in the process; however, this can only happen efficiently if capability design is a top-driven plan and from bottom-up discussions. SSE's analysis of the military procurement describes this issue as a misunderstanding of the final operational requirements presented to industry, yet the root cause of this issue is from the earlier stages of capability development. An example of this is how many projects will need to incorporate new requirements identified by Chief Force Development (CFD) just prior to getting approval at DCB. These last-minute additions are not considered in advance and can drive up costs dramatically from the original CIF plan which forces a CIFCP submission and another round of review and approvals. Although Canadian CBP process has flaws, it is not impossible to solve. It just requires a better level of overarching preliminary direction within the CBP process to ensure that projects can advance within assigned resources.

#### **Capability Design Issues, Staffing and the Regimental Systems**

This begs the question of what is causing these capability design issues? If an operating concept such as *Close Engagement*<sup>74</sup> describes the ideal land force for the CAF to achieve its missions and the sponsor provides oversight on capability development, how can these missteps still be occurring? This can be explained by examining *Advancing with Purpose: The Canadian Army's Modernization Strategy* (AWP). As the "Better Defined Concept" document after *Close* 

<sup>&</sup>lt;sup>74</sup> Department of National Defence. *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations*. (Kingston, ON; Army Publishing Office), 15.

*Engagement*, AWP is supposed to provide further guidance on force development. For the most part, AWP does an excellent job in describing the CA's vision for land operations in the FSE. It prioritizes the efforts of the CA and it describes how the CA will invest in new equipment. What is problematical is the force design portion of the document as well as the use of the regimental system in capability development.

Force 2025. (DLFD Lead) The Canadian Army's current force mix and structure is based upon the Force 2013 construct and has evolved with the series of capability integration MIDs (Master Implementation Directives) that have been published over the past decade.<sup>75</sup>

This demonstrates that the CA is not continually reviewing its portfolio of capabilities as described within the CBP approach as there will be almost twelve years between force reviews. This should not be interpreted as a failure of the CBP process but a reflection of the pressure of implementing a staff heavy process in a small force like the CA.

This approach has led to force design advancing in an ad hoc manner. As described in

AWP, force 2013 was designed with capabilities that were in response to the war in Afghanistan

yet that is only one out of the eight missions. What is required is a complete review of the CA

and a new force design that will optimize the force for all of its possible missions. This

assessment is shared by the CCA as AWP mentions that unpopular decisions regarding

capabilities need to be made.

The realignment of Canadian Army force structure and missions will be necessary to invest in new capabilities and, where required, divest others of lesser relative benefit. This will require tough decisions.<sup>76</sup>

This encapsulates the problem with a "bottom-driven" approach and the issue with using the regimental system to lead capability development. Namely, each regimental Corps/Branch is

<sup>&</sup>lt;sup>75</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 45.

<sup>&</sup>lt;sup>76</sup> Ibid., 45.

very much focused on delivering capabilities that fit the mold of their customs and traditions vice serving the pan-CA operational tasks and missions. Frequently, capability development leads to tribal infighting as each Corps/Branch seeks to protect its own interests vice working on the capabilities that the CA needs in spite of the desires of their individual Corps/Branch. This situation makes developing new military capabilities challenging for capability development teams.

While it may appear that the regimental system cannot effectively conduct pan-CA force development, it is possible for the CA to work around this issue. While the regimental system plays an important role in the operations and esprit-de-corps of the CAF, the role it plays in capability development needs to be framed so that the regimental system works for the process not against it. Changing how the regimental systems works with CBP requires only a minor revamping of capability development teams vice any substantial changes to the CBP process itself or ending the regimental system itself.

To summarize the issues of CA Capability Development, it can be described as:

- Staff Intensive While the process is methodical, the process requires heavy staff effort and requires a great many steps to develop and deliver effectively. This means that the process is not sustainable within the current force construct;
- Risk Adverse CCA is not willing to re-start major capability design if it appears that resourcing may become an issue. As a result, scope will be sacrificed vice modifying the schedule or seeking out more resources;
- 3.) Tribal Because of the "bottom-driven" approach, the Corps/Branches have the ability to unduly influence or modify requirements that may result in capabilities that better suit their traditions vice the CA's operational needs; and

4.) Complex – Figure 3 shows an overview of the Capability Development process and it is incredibly complex with many steps and diffuse responsibilities. As a result, it necessitates a properly trained individual to lead the process.<sup>77</sup>

<sup>&</sup>lt;sup>77</sup> The CA has created the Land Forces Technical Staff Programme in Royal Military College to train officers and senior non-commissioned officers in the process of capability development and procurement.

#### **CONSIDERATIONS FOR CAPABILITY DESIGN**

Understanding the issues related to CA CBP, it is now possible to discuss how the CBP process can be modified to meet CA needs. As a process, the CBP provides a structure that sensibly allows a military to build capability in a measurable and defensible manner. It is also clear that there is a significant difference in the complexity level between the CBP process described in Figure 1 vice what the CA uses in Figure 3, which is the main reason that capability development can be so easily bungled. If one were to look at project timelines from the PAD, a typical capability development project will take on average 10 years and<sup>78</sup> the theoretical minimum time that is spent from ID to PA(Def) is four years. While this may not seem like a great deal of time, this represents almost half of the time spent in a project's life. If this period of time was employed more efficiently it could dramatically improve the speed of fielding new military capabilities. This is all the more critical in an information age military where technology is advancing at great speed. So, in order to discuss CBP process improvements, it is first necessary to identify the constraints that cannot be ignored in shaping a new process.

# **Constraints, Restraints and Resources**

As a part of good governance, the DND/CAF must advance capability development in a defensible manner. This means that similar to a piece of academic or scientific work, the process cannot just be some sort of arbitrary selection process that wishes away governmental policy or ignores governmental procedures. As an example, Figure 4<sup>79</sup> shows the capability life cycle and an acceptable solution cannot be to just remove the ID/OA phase going to straight to Definition. The documentation for ID/OA is critical to explain the operational requirements, options and

<sup>&</sup>lt;sup>78</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 61.

<sup>&</sup>lt;sup>79</sup> While Figure 5 is useful in demonstrating the project phases, it does reinforce the idea that major capital procurement is linear which is not always the case, such as expensive but low complexity systems upgrades which could be cyclical in nature.

analysis which justifies the expenditure of resources. These policies exist to provide oversight on the military procurement process and cannot be eliminated.

As well, it is also important to consider that many defence players play within the realm of capability development. As a part of a wider defence team, the CA's approach to capability development needs to consider the impact of the CIF and that the DND/CAF needs to resource all elements of the CAF,<sup>80</sup> so any approach to capability development needs to also be flexible. Flexibility is important because it is not uncommon for projects to slip out of their planned year in the CIF. This slippage in schedule creates opportunities for the CA to procure ahead of schedule, so the capability development process design should give the CA the flexibility to move capability development teams quickly between capability projects based on the availability of funding. Likewise, the capability development process should also allow the DND/CAF flexibility in delivering capabilities in a manner that allows for times when resourcing is constrained.

In summary, a new process would need to simplify a complex process but, at the same time, still provide the necessary documentation to justify the desired military capabilities and its associated costs. As well, the process would need to account for the risk adverse nature of major capital procurement, the limited amount of capability development staff and the tribal nature of the Corps/Branches of the CA. While this may seem to be a difficult challenge to overcome, building this type of agility and efficiency is possible.

<sup>&</sup>lt;sup>80</sup> Department of National Defence. *Defence Investment Plan 2018: Ensuring the Canadian Armed Forces is well-equipped and well-supported (Annual Update 2019).* (Gatineau, QC; National Printing Bureau, 2019), 10.

## **Considerations for CA Capability Development**

While organizational efficiency and agility is not a new concept within DND/CAF, it has not necessarily been implemented successfully as there has not been a comprehensive review of organization or its processes. So, while the PAD was updated in 2019, the CA itself has not updated its own internal processes. This is not to say that the organization is a complete failure just that many of the processes were built in an ad hoc manner as a response to an external stimulus, such as the Jenkins report, vice a comprehensive organizational review. For example, IRPDA's function is described as:

IRPDA mandate is to validate the requirements for major military equipment procurement by providing independent, third party advice to the MND and DM before MND or TB approval for these projects is sought.<sup>81</sup>

While on the surface, it may make sense to have an independent body validate military requirements, it just demonstrates the fact that military is failing at describing its operational requirements and that more training and work needs to be done to improve the explanations of operational requirements. Although clarifying operational requirements will speed up procurement vice hindering it in the bigger picture, this approach doesn't address the root issues of poorly written requirements. So while IRPDA does provide value added, it is a sub-optimal solution to have a review authority catch problems late in the ID and OA phase vice addressing the question of why military requirements are being produced in an unclear manner. A better solution would be into include industry, defence scientists and procurement specialists earlier into the process to clarify key documentation.

<sup>&</sup>lt;sup>81</sup> Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC; National Printing Bureau, 2019), 61.

Tied to unclear requirements, *Close Engagement* and *AWP* have conceptually described a "system of systems"<sup>82</sup>(shown in Figure 7) combined arms approach to future operations; however, as described previously, the capability development still remains stove piped within each Branch/Corps.



Figure 7 – CA Land Power "System of Systems" Concept

Source: Department of National Defence. Advancing with Purpose: The Canadian Army Modernization Strategy. Kingston, ON. Army Publishing Office. 18.

In order to create organizational efficiency and agility, there also needs to be a new

paradigm to create integrated capabilities. This shift in approach is premised on the fact that the

<sup>&</sup>lt;sup>82</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 3.

CA seeking to change its force at the enterprise level with the enterprise being jointly integrated brigades and combat teams.<sup>83</sup> This level of innovation is known as *complex innovation*<sup>84</sup> with complexity being derived from the high degree of integration in a vertical (i.e., Battle group to Brigade group) and horizontal (i.e., Combat Team to Combat Team) manner which also needs to be scalable. (i.e. fire teams to brigade groups) This level of scalability and integration requires a great number of supporting systems (i.e. computers and communication systems) that operate in very different domains (dismounted soldiers, mounted soldiers and large tactical HQs).

As such, an enterprise-level solution requires a digitized enterprise resource planning (ERP) system and approach. ERP system is described as software that integrates their business processes and all the information relevant to their business. As well, beyond standardizing processes across the enterprise, it also helps management improve their knowledge of the ongoing business through the provision of real-time information.<sup>85</sup> Although one could argue that the CA's adoption of Microsoft SharePoint reflects an enterprise level information sharing solution, this is not an actual process, it is merely a tool that enables information sharing. This approach is critical because it efficiently harnesses the organizational knowledge that exists within the CA and will inform the Resource Allocation Framework (RAF) which will be discussed in further detail later.

Beyond the requirement for superior coordination and knowledge management is the need for organizational flexibility and simplified processes. The military is a highly fluid and dynamic organization. Personnel are moved frequently or individuals may not be able to function

<sup>&</sup>lt;sup>83</sup> Department of National Defence. *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations*. (Kingston, ON; Army Publishing Office), 8.

<sup>&</sup>lt;sup>84</sup> Amol T. Kharabe. "Organizational Agility and Complex Enterprise System Innovations: A Mixed Methods Study of the Effects of Enterprise Systems on Organizational Agility." (ProQuest Dissertations Publishing, 2012), 2.

<sup>&</sup>lt;sup>85</sup> Fiona Fui-Hoon Nah and Santiago Delgado. "Critical Success Factors for Enterprise Resource Planning Implementation and Upgrade." *The Journal of Computer Information Systems 46, no. 5* (2006), 99-113.

in their position for a myriad of reasons such as career training, personal illness or postings related to operations. This heavy pressure on personnel means that any sort of change to the organization needs to ensure both redundancy and simplicity to facilitate quick changes in staff to ensure minimal down time for capability development to cope with incoming and outgoing personnel.

Using these considerations, constraints and restraints it is possible to investigate where the CA is underperforming and identifying better practices to speed up capability development; however, this will require a deep dive into both organizational knowledge and organizational process and a detailed examination of the linkages between the CA's various capability development directorates to frame the optimization of capability development.

# **Creating Organizational Efficiency and Agility in Capability Development**

It is important to note that organizational efficiency can be described from many perspectives. DND may argue that the current CA capability development process is efficient because it produces the requisite information for capability development within the timelines stipulated in the PAD while some would disagree with this assessment.<sup>86</sup> For the purpose of this paper, organizational efficiency refers to the CA's ability to *economize effort* while delivering the best possible results. As with project management, if enough resources are thrown at a problem, it is entirely possible to accelerate project deliverables so it would not make for a strong argument to present a dramatic surge of personnel to continually conduct capability development activities. Especially given the fact that there are shortages of personnel for other operational tasks and capability development is a continual process within the CAF. Finally, this

<sup>&</sup>lt;sup>86</sup> David Pugliese. "Military procurement a success, says DND — MP questions whether the department has lost touch with reality." *Ottawa Citizen*. April 25, 2021. https://ottawacitizen.com/news/national/defence-watch/military-procurement-a-success-says-dnd-mp-questions-whether-the-department-has-lost-touch-with-reality

paper will not be focusing on actually measuring actual personnel numbers rather it will discuss efficiency of organizational groupings and process which would enable overall efficiency through increasing overall output.

Along with improved organizational efficiency is the concept of organizational agility. Organizational agility refers to the ability of an enterprises to adapt and respond to continuous and unpredictable change.<sup>87</sup> Within SSE,<sup>88</sup> the military is expected to be able to deal with a constantly shifting, complex and unpredictable security environment. This premise necessitates the requirement for a capability development process that also must be agile as efficiency alone cannot produce the desired outputs. Agility to switch the CA's capital investment plan and taking advantage of spending opportunities would be a major efficiency that the CA could exploit. This agility would also enable the CA to incorporate rapidly evolving or new technologies as part of project design; however, building this level of agility is challenging because the current capability development process is complex and decision-makers are naturally risk-adverse. As such, decision-makers require either significant corporate knowledge or a reference guiding document before they are confidently able to undertake such large, costly, decisions.

That being said, creating better organizational efficiency and agility is possible. It would just require that the CA leverage its organizational knowledge and effectively share this information. While this seems obvious, it is a major hurdle to overcome within the CA's Corps/Branch system of organization. Even worse, important connections between the directorates such as CALWC, DLR and DLFD are weak primarily because of geography, as all

<sup>&</sup>lt;sup>87</sup> Katharina Harsch and Marion Festing. "Dynamic Talent Management Capabilities and Organizational agility—A Qualitative Exploration." *Human Resource Management 59, no.* 1 (2020), 43-61.

<sup>&</sup>lt;sup>88</sup> Department of National Defence. *Strong, Secure, Engaged: Canada's Defence Policy*. (Gatineau, QC; National Printing Bureau), 14.

three directorates are located in different cities.<sup>89</sup> Although geography should not inhibit effective team activities, there are also issues within how capital projects are managed and the conceptual lines of development. For example, CALWC manages capability development within the 5 operational functions (i.e., Act, Shield, Sense, Sustain and Command) while DLR manages equipment on the aforementioned Corps/Branch system. This issue contributes to a breakdown in organizational knowledge and lowers both efficiency and agility. As such, optimizing knowledge management is an important facet to optimizing the process.

#### Using Organizational Knowledge to Improve Outcomes

Organizational Knowledge refers to the intra-organizational ability to tacitly and explicitly share information amongst the enterprise's employees.<sup>90</sup> The inability to effectively share information can have a number of negative outcomes. These are:

- Duplication/Re-creating of knowledge: This is a situation where employees can spend hours of time looking for information that is already held by other members of the same organization;
- Reduced levels of organizational commitment/focus: Employees start feeling frustrated when information that should be readily shared/known is not easily accessible;
- 3.) Sub-optimal organizational output: When information is not embedded into the organizational process, organizational outputs do not incorporate all of the corporate knowledge which can lead to both gaps and flaws in the solutions provided;

<sup>&</sup>lt;sup>89</sup> CALWC is located in Kingston, ON while DLFD is located in Carling Campus in Ottawa, ON with DLR being located in Gatineau, QC.

<sup>&</sup>lt;sup>90</sup> Alexander Serenko and Nick Bontis. "Understanding Counterproductive Knowledge Behavior: Antecedents and Consequences of Intra-Organizational Knowledge Hiding." *Journal of Knowledge Management 20, no. 6* (2016), 1199-1224. https://search-proquest-com.cfc.idm.oclc.org/scholarly-journals/understanding-counterproductive-knowledge/docview/1829489090/se-2?accountid=9867.

- 4.) Reduced organizational competitiveness: Corporate knowledge that is not allowed to freely flow across the organization will also impede in an organization's innovation as more time is spent in problem definition vice problem solving; and
- 5.) Loss of organizational knowledge: When employees leave the organization, important corporate knowledge is lost.<sup>91</sup>

It is possible to remove these organizational knowledge problems in the capability development realm. Any improvements in these areas will improve organizational knowledge and lead to improved organizational efficiency and agility.

The question then becomes how one can improve the enterprise to achieve better organizational knowledge? This can be addressed by first determining where efficiencies lie in the current capability development process, streamlining the organization and then finally adopting new technologies and systems with the view to improve organizational knowledge and accelerating workflow. This will be discussed in further detail in Chapter 5 – Optimizing Capability Development.

<sup>&</sup>lt;sup>91</sup> Ibid., 1202-1203.

#### **IMPROVING CA CAPABILITY DEVELOPMENT**

Addressing change in CA CBP will require the CA to bring together the identified issues, constraints, restraints and desired outcomes. As well, improving the CA capability development process will require re-visiting the principles of CBP in order to identify the critical path that the CA must follow when doing capability development planning. Using this critical path, it will then be possible to determine where inefficiencies lay and identify where the CA can refine its CBP process.

It is important to note that change management must be conducted rigorously and regularly to ensure that the process remains clear and continuous, evolving as necessary. Clarity is critical, as it is entirely possible to have staff, which are in short supply, quickly be absorbed into meaningless bureaucratic work. In essence, CA staff should be developing good plans and not focused on process. To that end, this section will examine the current "Conceive, Design, Build, Manage" process and identify where the CA can find efficiencies.

# CA and the Resource Allocation Framework

As depicted in Figure 3, the role of conceive in CBP is to address identified capability gaps with potential solutions. This step is focused on creating a number of potential solutions. In the Canadian model, this step is mirrored in exactly the same way but it misses a critical piece of guidance, namely resource guidance. Frequently, Canadian capability development staff will state that solutions should not be framed or restricted by resources; however, this assumption does not operate within the realities of Canadian military procurement which is resource constrained. Paul Davis, discusses how resource constraints can be a major issue that staff need to consider within the CBP process.

Typically, this is provided as a RAF<sup>92</sup> yet no such document exists in the CA. Ideally, this guidance would be produced after "Trade-offs and Decisions" as shown in Figure 5, as it would explain the analysis and reasoning for resource allocation in relation to strategy. It is also important to note that SSE, DIP and DIP 2019 are not RAFs, they are merely spending plans with no justification on how allocations were decided. A RAF describes empirically how much of a given resource should be allocated to a given scenario/mission space using analysis and empirical evidence to justify allocations.<sup>93</sup> Without an RAF, decision-makers are left to use intuition to determine how various competing capabilities will meet the needs of the CAF instead of using analysis. This usually leads decision-makers to use experience or regimental traditions to answer the important question of *what and how much* the DND/CAF should invest into a certain capability. This is problematic as managing change needs to be based on analysis of the operational requirements as novel solutions may be outright dismissed if it does not fit the mold of the designated Corps/Branch.

To illustrate this issue, one can look at the Ground Based Air Defence (GBAD) capability and the hurdles it has faced in advancing to implementation. The CIF has a value of \$350-450M<sup>94</sup> for the GBAD yet the project has not been able to receive PA(Def) because the ROM cost of the capability more than doubles the planned cost in the CIF. What has resulted is an internal discussion with key decision-makers as they try to determine trade-offs and offsets in order to find the necessary funding for the project. This discussion, in turn, has led to some debate regarding the number of complete GBAD systems the CA should procure because the

<sup>&</sup>lt;sup>92</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (RAND Corporation; 2002), 36.

<sup>&</sup>lt;sup>93</sup> Ibid., 36.

<sup>&</sup>lt;sup>94</sup> The author is unable to publish the exact CIF amount as this information is protected by the DND/CAF procurement process.

costs and benefits are not completely known. This is not an isolated issue as cost overruns create a domino effect as other projects cannot advance if they potentially have to be cut to fund GBAD. If the CA had already determined in a RAF how much it was prepared to invest in a given capability this would not be an issue because the future concept would have known how much of a given capability it *must* have to meet its capability-based scenarios.

While identifying a comprehensive RAF may sound like a complicated affair, it is a necessary evil to introduce discipline and accelerate a slow and complex process. It ensures that military planners have evaluated potential pitfalls to their capability roadmap and can readily advise on various options to meet operational requirements. It is also critical that the RAF be updated annually to ensure that capability development and procurement remain aligned. While major capital projects get much of the attention, the CA also manages a minor capital projects budget of ~\$30-60M/annum<sup>95</sup> which could be leveraged to fill small capability gaps. This leads to question of why the CA is not following such an important step in the CBP process?

#### Why is the CA not using Resource Allocation Framework?

The issue of the RAF is a result of staff shortfalls. While CALWC works on conceptual ideas, it does not work on resource guidance because project funding occurs as part of a procurement process and not as part of the preliminary capability development discussions. Given that it can take upwards of a year of intensive staff work to create a single Request for Information (RFI) to industry to obtain ROM costs, it is self-evident why capability development staff avoid costing capabilities until it is clear that a project will likely be funded. Beyond the extensive staff effort, it can be detrimental to business relationships to ask industry to prepare numerous bids if the projects will not be realized as there is a significant cost to preparing bid

<sup>&</sup>lt;sup>95</sup> The exact figure is protected information and managed by DLR on behalf of the COS A Strat and CCA.

responses. Tied to the issue of cost, timelines can also make costing exercises impractical as no company is willing to honour an old ROM cost and will naturally ask to provide accurate costing closer to the bid issuance timeframe. These issues make costing exercises undesirable at early stages of the capability development, despite the fact that military planners require the information to resource a capability development plan.

Beyond the planning challenges of costing new capabilities and the lack of staff capacity is the issue that building a comprehensive RAF cannot be effectively conducted in the current organizational structure. With half the organization being aligned by operational function and the procurement staff by Corps/Branch, there is a natural fissure in the capability development team so despite having a sound operational concept, such as CE and AWP, the Corps/Branches are left to develop solutions. This approach allows each Corps/Branch to protect their allocated resources and advance projects that may not be congruent to the operational concept. Invariably, this situation creates conflicts between what the CA requires, and the Corps/Branches would like to do.

To illustrate this issue, the CA ISTAR capability is a multi-disciplinary capability that touches the Artillery, Armoured, Signals and Intelligence branches yet there is no singular responsible Corps/Branch to lead, plan and prioritize future CA ISTAR equipment. Each Corps is allowed to advance their projects because the CA utilizes a "first out the gate" approach to select projects for delivery. This has resulted in the new reconnaissance vehicles being developed missing communication suites, signal intelligence capabilities that cannot provide digital connections to the new small, unmanned aircraft systems (SUAS) and a host of other issues that the CA must mitigate to create the desired conceptual vision. Ultimately, this mix of equipment will require another equipment project to patch these sensors and C2 systems together in a coherent fashion which eventually leads into cost overruns, lowered efficiency and more delays. Addressing the issue of a RAF requires a new approach to capability development. This approach would require a realignment of the capability development organization into holistic multi-disciplinary groupings.

## **Organizational Change and the Resource Allocation Framework**

A RAF requires a singular vision for the overall system and clear delineation of the subsystems. It should focus the organization and provide clear guidance to the capability development team. Figure 8 shows a diagram of the level of knowledge that the CBP planning team would need from an effective RAF. It outlines all of things that the planning team would needs to consider in order to effectively design and integrate capabilities vertically and horizontally. The diagram also illustrates what the RAF would need to consider for multi-era capabilities as well as the necessary supporting shaping activities to deliver a comprehensive military capability.



Figure 8 – CBP Organizational Planning Considerations

Source: Paul K. Davis, Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation, (Santa Monica, CA; RAND Corporation, 2002), 44.

As shown earlier in Figure 7, the CA's operational vision is to have a "system of systems" that scale upwards from a single soldier up to joint brigade groups in five levels.<sup>96</sup> As the scaling ascends vertically, it also extends horizontally as the assets at each level are expected to provide mutually supporting capability. This scaling requires better integration and system interoperability but also requires decisions on what legacy systems should be carried forward. As well, there also needs to be a conceptual view on how the Canadian systems will integrate into a wider defence establishment, such as North Atlantic Treaty Organization (NATO). This complex

<sup>&</sup>lt;sup>96</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 18.

layering and integration in capability design requires a significant amount of organizational knowledge to properly execute. Therein lies the problem with the current organizational approach to capability development.

The use of singular Corps/Branch approach inhibits the CA's ability to leverage its organizational knowledge because it creates natural stove pipes and does not bring the key players into a close-knit network. H.C. Triandis, a psychologist, describes the importance of "facilitating conditions"<sup>97</sup> that "include the state of the actor and any environmental conditions that make the act easy" in the *Triandis model of interpersonal behaviour*. This model describes the importance of organizational layouts and their impact of organizational behaviour. This theory applies to military organizations because the organization is both large and complex. If group membership and focus of work is not clear, knowledge gaps appear. Only when the organization is clearly established in both membership and focus will the organizational structure enable its members to engage in knowledge sharing behaviour. This is the primary reason that layering a digital system of knowledge management, such as MS SharePoint, has not resolved the issues of timely capability development or dramatically improved corporate knowledge.

As such, the capability development organization would need to be modified to reflect the desired resulting military capability. Essentially, if one wants integrated combat teams, the capability development team should also have the same knowledge as the operational community to ensure both system integration and capture of the wider design vision. Although there is no perfect grouping, one optimized approach could be to create a multi-disciplinary grouping by operational function (i.e. Sense, Act, etc) as CALWC is organized, this would ensure that capabilities are vertically integrated. Another approach could be to create a multi-disciplinary

<sup>&</sup>lt;sup>97</sup> H.C. Triandis. Interpersonal Behavior (Monterey, CA; Brooks/Cole Publishing Company, 1977), 76.

grouping by conceptual level (i.e. Brigade Group, Battlegroup, Combat Team, etc) to promote horizontal integration and enforce vertical integration via operational function. There are a number of ways to organize and it is important to note that there is not one "right" way to build system integration but there are numerous "wrong" ways to do it. So, this paper will not focus on a particular "right" approach and just identify the issues with the current approach for consideration.

Beyond the military personnel required to do capability development work, it would also be advantageous to realign supporting civilian staff to these groupings to further increase the organizational knowledge. Placing defence scientists into these capability development groupings would significantly align and prioritize scientific research. As well, including procurement specialists into the capability development teams early would help the team select proper project types as part of the Identification phase. With a realigned organization, the organization could then operationalize CE and AWP with a detailed RAF that provides direction and guidance for each operational function or for each operational level, depending on the approach that was taken. Essentially this would be "system of systems" capability development plan.

Although this may seem like a simple chair moving exercise, an organizational realignment is the first step to the RAF, namely allocating personnel towards the desired capabilities. Once the organization is assembled, the groupings would then be able to focus in on their capability grouping's focus to develop the refined operational concept. While CE and AWP provide excellent higher level operational concepts for the CA "system of systems",<sup>98</sup> it does not break down or prioritize the next level of capabilities that the CA wants to build. Essentially,

<sup>&</sup>lt;sup>98</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 3.

what is missing is how one deduces from the CA's vision<sup>99</sup> an agile, scalable, modular force and how much of a given military capability is needed to achieve the desired mission effects.

This is where an improved capability grouping could analyze and develop operational level concepts with higher fidelity. To illustrate, if the CA were to use the Operational Functions approach, the "sense" grouping would be able to then design, test and evaluate a comprehensive sense capability for the CA. These holistic designs would be in much greater detail than CE and AWP and would cost a number of systems as part of a larger portfolio of sense capabilities. This portfolio would conceive of everything within the "sense" realm from Command and Control, Communications and Computers systems for Intelligence, Surveillance and Reconnaissance (C4ISR), land and airborne sensors, and Intelligence, Surveillance and Reconnaissance (ISR) digital tools.

Having both operators and technical experts working closely will result in welldeveloped, detailed, operating concepts. This concept would also answer the question of how much of a given asset is required to meet the CA's larger operating concept. It may seem like this approach would be creating a new layer of work to an already complex process but, in reality, it is actually providing structure to the most challenging stages of capability development which is answering the question of how a given military capability will fit into a larger operational picture. This concept can then be used by every underlying capability "sub-system" as its own overarching guidance to frame how the capability will fit into CA's greater operating vision.

<sup>&</sup>lt;sup>99</sup> CA's vision is a land force that is "agile, connected and modular, and thus able both to work in a widely dispersed stance and to concentrate for effect, will continue to be able to succeed in full-spectrum operations." Department of National Defence. *Close Engagement – Land Power in an Age of Uncertainty – Evolving Adaptive Dispersed Operations*. (Kingston, ON; Army Publishing Office), 55.

An example of how this structure will result in better efficiency is by examining the current process. Currently, each capability requires a set standard of documentation to advance forward to the MND/TB for approval such as an SCD, BCA, etc; however, if certain documents remain extant there is no need to create further documentation to justify an operational requirement. As an example, every CA SCD will cite SSE and CE as a critical capstone justification for the development of a particular capability. If the CA were to take it to the next level down and create a RAF that stated its operational approach for each function, every future military capability that is developed within that same operational function would be able to cite the same operational requirements, dependencies, and HLMRs instead of creating a new SCD for each capability. Essentially, the RAF would become the SCD for a number of projects. Figure 8 illustrates this efficiency in the Conceive/Project Identification phase of capability development:



Figure 9 – Example Resource Allocation Framework Model for Operational Function "Sense"

This approach would allow military planners to start prioritizing sub-capabilities holistically and move into Options Analysis with a better understanding of how a given system will interact with other dependent military capabilities. It is also important to note that this approach would reduce the number of external authorities required to integrate the sub-system into the larger system. In the Figure 8 example, each project within ground and air sensors would need to link in to first understand the Digital C4ISR's SCD as well as any other external dependencies to create necessary digital IT connections; however, in the optimized model, the RAF/SCD will direct the supporting projects on how they will be integrated and networked. It would also establish the priorities and resources to ensure that enough capability was procured to deliver a "complete" system vice a decentralized approach which could deliver insufficient or surplus numbers of sub-systems which is an inefficient use of resources.

## Using the RAF in the Design and Options Analysis phases

With a reorganized Capability Development Team and an approved RAF, it is then possible to provide better guidance and fidelity during the Options Analysis Phase. Currently in the stove piped model, each project develops three options with the SCD for decision-makers to select. Usually, there is a status quo option and two other options with varying costs and capabilities. The only issue with this approach is that the options are never analyzed in a holistic manner. Essentially, the SCD will outline a very high level of requirement from SSE and CE and then jump right down to a particular capability such as the operational requirement for a specific military capability, such as a regiment of tanks. What is missing in the SCD is the analysis that justifies the "how much" question<sup>100</sup> in a manner that explains how the sub-system interacts with the larger system.

<sup>&</sup>lt;sup>100</sup> Chief Force Development. *Capability Based Planning Handbook*. (Gatineau, QC: National Printing Bureau; 2019), 35.

While the RAF will answer this question, it requires baseline information to determine the resources each operational function/grouping will need to meet the assigned missions. The baseline information can then be analyzed against new capability options which enables the CCA to make informed decisions about capability development. There are a number of approaches to get this baseline information. One such approach was attempted in the mid-2000s with 2<sup>nd</sup> Royal Canadian Regiment (RCR) in CFB Gagetown. The optimized battlegroup experiment (OBG) had a stated mission of providing a scientific, professional and comprehensive approach to develop the "Army of Tomorrow".<sup>101</sup> The experiment was well established and had an excellent scope of study and clear objectives, namely, to determine the optimum mix of capabilities to deal with the FSE and Contemporary Operating Environment (COE). The only failing with this approach was the fact that it was extremely personnel-intensive, episodic and disruptive to the participating study group.

The OBG approach was sub-optimal because it double-hatted the participants. 2 RCR members had to conduct their routine operational activities while still providing feedback and information to the force development staff in Kingston. It also created additional stressors on military personnel as the selected unit was not co-located with other combat enablers so many personnel were posted into 2 RCR from the artillery, armoured and engineer Corps to participate in the study. This approach was disruptive to the member's lives and expensive for the CAF to maintain. Although the stated goal was to run the experiment indefinitely, the CA ended the experiment in 2011 as it was too costly to maintain in personnel, funding and readiness.<sup>102</sup>

 <sup>&</sup>lt;sup>101</sup> Peter Gizewski National Defence and the Canadian Forces. *Toward Land Operations 2021: Studies in Support of the Army of Tomorrow, Force Employment Concept, edited by Godefroy, Andrew B.* (2009), 5-3.
<sup>102</sup> Ibid., 5-3.

Despite the early termination of the OBG, the study results significantly informed Adaptive Dispersed Operations 2021 and helped shape CE. Although, the OBG approach was not the optimal method to gather information, it does not negate the fact that experimentation is a critical component to the developing concepts and conducting options analysis. The ability to test a complete force design is an important component in validating planning assumptions, analyzing force interactions and assessing force composition. As such, the CA needs to conduct this level of experimentation but in a more efficient and less disruptive manner. It also needs to be conducted regularly to keep CBP relevant, as it is not optimal to run a single experiment and use it as the basis for all future design. A single experiment represents a snapshot in time and does not capture technological advances, changes to the operating environment or amendments to missions and operational tasks.<sup>103</sup>

## **Optimizing Capability Design through better Processes and Technology**

Understanding the importance that broad experimentation plays in the development of the RAF, the CA should update its experimentation program and leverage its relationship with DRDC. While DRDC runs a number of scientific programs, these programs are dependent on CA funding which is normally provided by the Project Directors. This approach does not ensure that scientists are employed on the right projects and it is entirely possible to have scientific studies being completed that do not support any capability development activities.<sup>104</sup>

To align scientific resources, capability development planners should resource scientific research as part of the RAF, this approach would allow the project leads to use defence scientists

<sup>&</sup>lt;sup>103</sup> A. Bradfield, G.L. Christopher, D. Maclean. Department of National Defence. *The Development of a Scenario Set for Departmental Force Planning*. (Ottawa, ON; November 1998), 5-9.

<sup>&</sup>lt;sup>104</sup> While DRDC laboratories are specialized in areas of studies, there is frequently a misalignment between sponsored study timelines, expected results and their usefulness within the capability development cycle. This disconnect has led some Project Directors to ignore using this important asset.

to support multiple spirals of force design vice working on singular projects. Tied to this reasoning is the fact that scientific studies also follow their own project approach so the results of their studies inform parts of preliminary design. As well, having regular scientific input into force development is critical to ensure that military planners have access to scientific advice when outlining the risks in future force design.

Along with defence scientists, preliminary models or prototypes of capability are extremely useful for military planners as part of the options design. According to Army Capability development continuum (Figure 3), during the Conceive-Identification phase only a high-level developmental structure is initiated with force structures being validated after the first DCB during the design phase.<sup>105</sup> This approach was sensible when technology was limited but it makes little sense to wait until the design phase to create high fidelity force structures for analysis or to follow a 3 year analytical cycle when it is possible to build virtual models and project outcomes in very short periods of time.<sup>106</sup> This is where important technological advancements could be utilized to speed up capability development, visualize options and provide baselines for analysis.

One of the key technological advancements that have alleviated both training and operational costs have come from computer assisted modelling and simulation (CAMS). CAMS would enable military planners to build a complete CA order of battle and replicate the OBG experiment to draw some initial planning assumptions and conclusion. Such a process would not replace actual field experimentation or knowledge, but it would provide the CBP planners with a baseline force that could be based analyzed scientifically to develop RAF options and refine

<sup>&</sup>lt;sup>105</sup> Canadian Army Staff, Army Governance, PowerPoint briefing, 1 August 2015, slide 10.

<sup>&</sup>lt;sup>106</sup> Modeling & Simulation Caucus Congressman J. Randy Forbes, Chairman. "A Primer on Modeling and Simulation" *The World of M&S*. (National Training and Simulation Association, Arlington, VA, 2007), 3.

designs. Utilizing the scientific expertise of Defence Research and Development Canada (DRDC) scientists, it would be very possible to bound the desired military capabilities, FSE, COE and potential missions in order to answer the question of "how much" of a given military capability is required. Paul Davis refers to this type of analysis as Mission-system analysis (MSA).<sup>107</sup> Such analytical systems already exist and are being recommended for the future space capability development planning process because the planners face many of the similar problems such as a complex environment with rapidly changing technology.<sup>108</sup>

This is not to say that the CAF does not use modeling and simulation;<sup>109</sup> however, there needs to be a concerted effort to use CAMS earlier in the capability development continuum. This approach would allow military planners to create very concrete HLMRs, preliminary operational requirements that would allow procurement staff to approach defence industry with very specific operational requirements questions earlier in the capability development process. To illustrate how this could be implemented, military planners could essentially create a virtual CA with the current portfolio of capabilities. Next, working with defence scientists, intelligence staff and simulation experts, the OBG could be examined through the force planning scenarios virtually. The results could be then examined to determine where capability gaps lie for each scenario. These capability gaps could then be prioritized based on risk-based criterion to ascertain how significantly they jeopardize mission success. Capability Development staff then could approach industry with pointed questions to discuss potential solutions that could be

<sup>&</sup>lt;sup>107</sup> Paul K. Davis. Analytic Architecture for Capabilities-Based Planning Mission-System Analysis and Transformation (RAND Corporation; 2002), 39.

<sup>&</sup>lt;sup>108</sup> Basar Kasım, Ahmet Birol Cavdar, Mehmet Akif Nacar, and Erdal Cayırcı. "Modeling and Simulation as a Service for Joint Military Space Operations Simulation." *Journal of Defense Modeling and Simulation: Applications, Methodology, Technology, Vol. 18(1),* 29-38.

<sup>&</sup>lt;sup>109</sup> The CAF utilizes M&S within the process but it is a mixture of low fidelity analytical tools that work in broad concepts and not high fidelity models that have high fidelity metrics that could be used for force design. M. Rempel. An overview of the Canadian Forces' Second Generation Capability-Based Planning Analytical Process. (Ottawa, ON: Defence Research and Development Canada Centre of Operational Research; 2010), 8-12.

analyzed by defence scientists.<sup>110</sup> This information would then inform military planners on where CBP needs to focus its efforts to create true capability-based options. Figure 9 illustrates the new grouped options using the "Sense" example:



# Figure 10 – From Concept to Resource Allocation Framework Options using the "Sense" operational function

One of the key benefits to this approach is that modeling and simulation allows military planning staff to empirically examine capabilities as a system vice looking only at individual capabilities. CAMS excels at providing end users with answer to questions of "What if?" and "So What?" in a systemic and defendable process.<sup>111</sup> It also allows military planners to examine

<sup>&</sup>lt;sup>110</sup> It is important to note that these discussions would not be formal RFI's but general questions surrounding their solutions. The solutions could be assessed by defence scientists for feasibility and entered into the model. These engagements are regularly conducted by Capability Planning staff but are more "horizon scanning" vice pointed questions that could be validated in a model.

<sup>&</sup>lt;sup>111</sup> Modeling & Simulation Caucus Congressman J. Randy Forbes, Chairman. "A Primer on Modeling and Simulation" *The World of M&S*. (National Training and Simulation Association, Arlington, VA, 2007).

such things such as equipment lifecycles, advances in technology, training and integration early and enable decision-makers to make deliberate informed decisions on resource allocation and when unforeseen costs emerge. Ideally, it prevents tradeoff discussion from occurring too early in the capability development process by providing broader thoroughly evaluated options to decision-makers. It also would allow planners to inform plans for legacy equipment (i.e divestment planning).

## Using the RAF to engage with Defence Industry and Defence Scientists

Utilizing a RAF in order to create the SCD, it is then possible to take refined concepts of the desired future capabilities to defence industry for refinement. This approach is very useful as initial ROM costs would be more accurate because the level of precision within the RFI would be higher than the current approach. This would help military planners in ascertaining value propositions and identify viable options with costing that is more precise, minimizing the risk of cost overruns which can be significant within IT projects.

To illustrate this process, it may be useful to consider a case study. Currently, the CA has limited counter-UAS (CUAS) capabilities and is considering future capability options.<sup>112</sup> Presently, UAS have become increasingly inexpensive to produce. These cheap drones have also demonstrated that they are capable of both ISR and kinetic operations. This was recently demonstrated by a drone attack in Riyadh, Saud Arabia in 2019.<sup>113</sup> If the CA were to use a broader operational grouping approach (i.e. Shield) in the CBP process to develop options through CAMS for Counter-UAS, the option space may look like:

<sup>&</sup>lt;sup>112</sup> This project is entered as an investment opportunity within the CIF intake plan.

<sup>&</sup>lt;sup>113</sup> Ben Hubbard, Palko Karasz and Stanley Reed. "Two Major Saudi Oil Installations Hit by Drone Strike, and U.S. Blames Iran" *New York Times*. Sept. 14, 2019.

- Option 1: Electronic Defence Either Jammers or Signal Intelligence to detect and interdict drones and their ground control stations;
- 2.) Option 2: Kinetic Defence Ground or Air delivered munition systems to detect and interdict drones and their ground control stations; and
- 3.) Option 3: Passive Defence Improved armour systems and hardened infrastructure. Indicate Capability gap to "sense" operational group to develop better indicators and warning (I&W) system when operating in a drone threatened environment.

The options could be run alongside the rest of the operational functions through CAMs to determine attrition of personnel and equipment in various force scenarios. The results would then inform the prioritization of how the CA should look to fill the gaps. Utilizing these options, military planners could then engage with defence industry and defence scientists to determine which of these options are viable and approximate ROM costs to develop these options and the requisite time to build the capability. This new information could then be run through CAMs again to determine how the option space has changed. These updated results would provide the risks, costs, timelines and impact of a new capability within the current capability portfolio.

It may be entirely possible that the optimal solution is some mixture of any or all three of the proposed options that need to be managed over time<sup>114</sup> but this approach requires a multidisciplinary planning group to properly analyze. This analysis would help inform the level of risk that decision-makers would need to take if they waited until the completion of the current 20-year CIF plan or decide if the new capability needs to be prioritized into the CIF

<sup>&</sup>lt;sup>114</sup> It is possible that low TRL solutions may become more readily available. In the CUAS example, the CA may only be able to afford I&W system initially until defence industry is able to develop fieldable Kinetic or Electronic solutions if the decision-makers accept the risk that the threat poses.

immediately. As well, it also brings to the decision-makers as part of the plan where potential trade-offs should be made to resource the new capability if no new funding can be found.

# Better Options from Improved Organizational Agility and Knowledge

The RAF produces better options because it increases the breadth of the solution space for potential capabilities, but another side effect of a wider solution space is that it also provides military planners with clear on and off ramps to deliver a capability. Although capability development should not be hindered or driven by external projects that have no relevance to the desired capability, it is an unfortunate reality that competing priorities and availability of funding can impact capability development timelines. That is why the Canadian CBP process needs to be flexible to accommodate funding changes. In a perfect world, it would be possible to just move funding from one project to another with no impact on the iron triangle for each project but that is an impossible within the current construct. However, it is possible to optimize spending by grouping capabilities into larger project portfolios in order to leverage the same delegations of authorities under a Programme or Omnibus approach.<sup>115</sup>

In *Optimizing Military Capital Planning*, this approach is described as the "knapsack" model of acquisition<sup>116</sup> and provides planners with a methodology to select the best value option for a fixed budget. To illustrate, continuing with the sense example depicted in Figures 8 and 9, the sense portfolio manager would be able to use the RAF to identify potential savings and spending opportunities vis-à-vis three different sub-system capabilities (i.e. Air sensors, land sensors, C4ISR tools) to determine where to optimize available resources. If one project needs additional funding, it would be possible to identify savings from multiple sources that are

<sup>&</sup>lt;sup>115</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 41.

<sup>&</sup>lt;sup>116</sup> Gerald G. Brown, Robert F. Dell, and Alexandra M. Newman. "Optimizing Military Capital Planning." *Interfaces (Providence) 34, no. 6* (2004) (415-425), p 417.

already interconnected vice trying to find savings from within the same project.<sup>117</sup> These savings could come in the form of equipment divestment in order to reduce operational costs, delayed delivery of equipment or training from the other capabilities. It important to note that this approach is not unique to the RAF model but something that is optimized through improved organizational knowledge and grouping similar capabilities together.

## Leveraging Organizational Agility to arrive at Definition Faster

The optimized approach also allows military planners to arrive at Definition and Implementation with two major advantages. The first is that a wider portfolio also means a better understanding of the impacts and desired results of the greater suite of capabilities. It also means that there is significantly improved organizational knowledge of the permutations of capabilities that could be delivered as part of the portfolio. The second advantage is greater flexibility of resource allocation within the portfolio itself. Ultimately, this results in better informed and faster decisions regarding important facets of the overall capability.<sup>118</sup> This translates to clear and precise operational requirements for the desired capabilities. It also prevents circular discussions and unnecessary data mining from dependent projects if a portfolio manager is authoritatively able to explain the wider capability trade-offs.

As well, grouping similar projects together with multi-disciplinary staff also produces better flexibility within the staff itself. It is easier to have another member of the existing grouping carry on with the project in the event of the unexpected departure of a team member than it is to train another individual completely on a complex capability development file.

<sup>&</sup>lt;sup>117</sup> This approach was used with great success under the CA's Omnibus Sense project (Land Force ISTAR).

<sup>&</sup>lt;sup>118</sup> Within the CA's LF ISTAR project, additional funding for the Blackjack SUAS was obtained from the sister MRR budget as well as the overall contingency funding that was allocated to LF ISTAR. Blackjack SUAS required additional funding because the original project team underestimated the cost of maintaining two separate fleets of SUAS (Training and Operational). When it was decided that it would be more cost effective to operate a single fleet of SUAS, the project manager was able to swiftly move money from the rest of the LF ISTAR project to fund the procurement of additional SUAS capability.

Adding greater civilian support for capability development beyond just defence scientists and procurement staff would also be beneficial. Civilians within DLR, CALWC and DLFD would improve corporate knowledge by minimizing the impact of the loss of key military staff.<sup>119</sup> Deepening personnel pools, using a multi-disciplinary approach and creating a RAF would create a robust and flexible capability development plan. This approach would help the CA get more projects into Definition swiftly but operationalizing the process is the challenge in an environment where the CA does not want to stop ongoing activities to re-evaluate its process.

<sup>&</sup>lt;sup>119</sup> It is important to note that civilian staff do not necessarily have to be public servants. Contractors are an excellent human resource that should be considered for complex projects.

#### **OPERATIONALIZING A NEW CAPABILITY DEVELOPMENT PROCESS**

Optimizing capability development entails bringing the aforementioned conceptual changes together to address the overall process and avoiding patchwork solutions but the challenge is that the CA needs to continue to push its ongoing capabilities. Essentially, it is not possible to stop all capability development activities, introduce and train staff on a new process, while evolving the force. What would work for the CA is a phased approach to continue to finish the projects that are in Definition while building the new capability development teams. Once these teams are established with their own overarching guidance, they could start to absorb the legacy projects into their RAFs. This approach would allow the CA to continue to deliver new capabilities while starting to map out its new systems approach to force design. As part of this optimized approach, the CA would also need to manage the impact of detrimental outcomes as it transitions to an optimized process.

Although the PAD discusses risk in Project Complexity and Risk Analysis (PCRA)<sup>120</sup>, this metric only identifies the risk to decision-makers and does not resource risk mitigation measures.<sup>121</sup> This can be addressed better with a modified project management approach – described as an "Steel Tetrahedron" shown at Figure 10.<sup>122</sup> Essentially project teams should also consider managing detrimental outcomes as part of the project deliverable. Detrimental outcomes are described as unforecasted, undesirable outcomes that are caused by the project

<sup>&</sup>lt;sup>120</sup> PCRA falls into four levels: 1 – Sustaining, 2 – Tactical, 3 – Evolutionary and 4 – Transformational. The more complex and riskier the project is assessed to be higher the level it is assigned. Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC; National Printing Bureau, 2019), 5.

<sup>&</sup>lt;sup>121</sup> Department of National Defence. *Project Approval Directive v1.1*. (Gatineau, QC; National Printing Bureau, 2019), 58.

<sup>&</sup>lt;sup>122</sup> Ofer Zwikael and John R. Smyrk. *Project Management: A Benefit Realisation Approach*. Cham: Springer International Publishing AG, 2019. 162.

team while delivering a project.<sup>123</sup> In the CA's case, this would apply to unintended impacts to dependent projects and management of staff.



**Figure 11 – From Iron Triangle to Steel Tetrahedron** 

Source: Ofer Zwikael and John R. Smyrk, *Project Management: A Benefit Realisation* Approach. Cham: Springer International Publishing, (Cham, Switzerland; AG, 2019), 163.

Utilizing this approach would set up the CA for success while also managing change. As part of capability development, project design would also need to be considered as part of the capability development strategy. While not all new capabilities require procurement, procurement strategies are critical for the successful delivery of a new capability that has a heavy equipment or contracted (i.e. training or services) component.

In general, procurement will fall into two stages of the CA's capability development continuum: Design and Build.<sup>124</sup> It is important to differentiate between the Design and Build phase as the two phases represent the key periods when defence industry can be meaningfully

<sup>&</sup>lt;sup>123</sup> Ibid., 162.

<sup>&</sup>lt;sup>124</sup> Canadian Army Staff, Army Governance, PowerPoint briefing, 1 August 2015, slide 10.
engaged as they represent the natural contracting point. Within these two areas, the CA can choose to contract industry to:

- 1.) Design military equipment and training;
- 2.) Build military equipment; or
- 3.) Design and build military equipment and training.

The decision to include industry is very important in a capability development program as public perception can detrimentally impact the progress a major capital project. Although this paper does not intend to discuss politics, it is important to note that public perception can quickly stop or delay projects if it is perceived to be conducted inappropriately.<sup>125</sup> As such, the role that defence industry plays in an optimized process needs to be examined carefully as they hold much of the necessary information that informs decision-making. Likewise, engagement with industry needs to be managed carefully to keep them interested in participating within the process. With that perspective, this chapter will first discuss how the defence industry can be integrated into the capability development process, discuss the merits of their participation in each phase before discussing how they can optimize capability development process.

## **Defence Industry and Capability Development**

Typically, the CA engages with defence industry at key events in the capability development world. Such events like CANSEC and CA Outlooks provide a venue for the CA to engage with the industry writ large. As well, representatives from ADM(Mat) and CA frequently meets with industry in one-on-one meetings to discuss CA operational requirements and see technology demonstrations. As previously discussed, these meetings generally lack controlled

<sup>&</sup>lt;sup>125</sup> Phillip Lagasse. "Holding Canadian Governments to Account for National Defence.". In P. L. Edited by Thomas Juneau, *Canadian Defence Policy in Theory and Practice* (pp. 45-61). (Cham, Switzerland: Palgrave Macmillan; 2020), 45.

tests and scientific analysis. While defence scientist are not excluded from these meetings, the process remains ad hoc and too generalized to draw conclusive information about a given solution. This approach is also inefficient because each company has developed a vision for their products and the use case does not necessarily meet the CA's requirements which entails further discussions regarding how a technology could be modified to meet the given requirements. The difficulty with this approach is that these types of engagement are speculative in nature and do not generate solid information regarding costs, feasibility of integration and concrete specifications which industry is unwilling to share for free. What is more useful is a proof of concept or prototype to test within the CA's suite of capabilities but getting this type of product is impossible without a procurement contract.

Given the inefficiency of industry engagement via broad discussions, a possible option for the DND/CAF is to procure designs that the military can test. Although this comes with political risks that the CAF is building requirements to down select specific vendors, it allows the CA to test capabilities. It also helps CA staff with building the technical requirements of a future capability. The primary issue with this type of approach is that ADM(Mat) is the technical authority<sup>126</sup> for procurement and it can be perceived that the measurements of effectiveness and technical requirements are no longer being developed independently but with significant input from vendors. As such, this approach does not guarantee that a capability design will be perceived as fairly competitive which PSPC is mandated to ensure. As such, outsourcing design or procuring prototypes from industry needs to be carefully considered as part of the capability design as it is not necessarily more efficient or faster given the DND/CAF's procurement

<sup>&</sup>lt;sup>126</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 213.

processes. That being said there are many mechanisms in place to conduct "Buy and Tries" but it should be applied judiciously and with careful concern of public perception.

Where industry can be very valuable in capability design is within focused working groups and experimentation. DRDC has successfully conducted field trials and experimentation with defence industry through both scientific programs and the Innovation for Defence Excellence and Security (IDEaS) program. Under SSE, the IDEaS program is a governmental program to foster innovation in defence industry.<sup>127</sup> The program is mutually beneficial to defence industry as it provides them venues to test their solutions with feedback from both defence scientists and military operators.<sup>128</sup> This approach keeps the DND/CAF at arm's length from vendors, provides defence industry critical feedback and allows DND/CAF to survey the solutions at various technological readiness levels (TRL). It is actually better for the CA to avoid conducting "Buy and Tries" directly and to leverage DRDC to procure prototypes and test capabilities on behalf of the CA.

Incorporating defence industry into capability development is a complex issue. While there are no simple rules for how the industrial complex should be integrated in, capability development teams should plan this carefully. For projects with straightforward designs but with complex integration issues, it may be beneficial to consider a Public Private Partnerships (PPP). For projects with high degrees of risk, it is probably better to keep R&D within the DND/CAF and develop technical packages for competitive bid. Regardless of approach, the capability

<sup>&</sup>lt;sup>127</sup> Government of Canada. "Understanding IDEaS". Understanding IDEaS - Canada.ca

<sup>&</sup>lt;sup>128</sup> The author participated in an IDEaS CUAS "Sandbox" where over twenty vendors were able to demonstrate, troubleshoot and solicit feedback from CANSOF, RCMP and CA operators. The month-long experiment was beneficial for all stakeholders as the operator community was able to assess the viability of various solutions in the field, scientists could study various technology readiness level solutions and defence industry was able to obtain feedback from the operator community to improve their technology.

development team should always consider the detrimental outcomes that may present itself if a project team has not thought through its approach.

# **Public Private Partnerships**<sup>129</sup>

Defence industry can be very useful in shaping successful projects as they usually follow technology trends, understand how to scale technology for mass production and know how to integrate equipment and training to build a new military capability. While industry advocates, such as the Canadian Association of Defence and Security Industries (CADSI),<sup>130</sup> actively try to engage with the DND/CAF, it can be more beneficial to include defence industry within the capability development process itself. This type of inclusion could be done under a PPP. PPP are a relatively new approach for governments to execute complex projects.<sup>131</sup> A recent, successful, example, is the Champlain Bridge project in Quebec which had numerous stakeholders and contractors.<sup>132</sup>

While this governance model may seem like it should become common across all project approaches, it does have weaknesses. Namely, a PPP assumes that either a single vendor or a consortium led by a prime vendor is capable of designing and building a given project. So, this approach works well for projects that have a straightforward design but complex execution. Examining the Champlain project, its complexity was drawn from maintaining public

<sup>&</sup>lt;sup>129</sup> A short section was included to discuss PPP, as the governance model is discussed on professional certifications and PAD familiarization training within the DND/CAF. As part of the Complex Procurement and Project Leadership certification in Telfer University, Public Private Partnerships (PPP) are discussed as potentially good governance models for high complexity projects. As the certification is regularly provided by ADM(Mat) to public servants and military members from DND/CAF and attended other GoC employees as well as defence industry, there could be some questions regarding this governance model and CA capability development.

<sup>&</sup>lt;sup>130</sup> CADSI advocates for closer cooperation between DND/CAF and defence industry. They annually host events such as the Canadian Security Conference (CANSEC) and CAF Outlooks to build stronger ties.

<sup>&</sup>lt;sup>131</sup> Huanming Wang, Wei Xiong, Guangdong Wu, and Dajian Zhu. "Public-Private Partnership in Public Administration Discipline: A Literature Review." Public Management Review 20, no. 2 (2018): 293-316.

<sup>&</sup>lt;sup>132</sup> Pont Champlain is a successful PPP that has been cited as a model for Project Governance on complex projects in the Complex Project Project Leadership Program. https://www.samueldechamplainbridge.ca/primary-stakeholders/partners/

governance and oversight, managing current bridge operations and construction and ensuring stakeholder satisfaction but it is very important to note that *the project was still just a bridge*. This statement is not to take away from the project team's success but the project complexity and risk did not have concerns regarding politically difficult-to-justify costs such as R&D so while it may have a high PCRA score, the score does not represent the challenges that are inherent in mitigating risks related to cost recovery of systems that may not get chosen for Implementation.

Thus, PPP should be considered carefully as part of the project design process. Some projects would benefit greatly from a PPP governance model as it provides good stakeholder experience and generally well delivered projects.<sup>133</sup> While there is no clear-cut mechanism for determining when a project team should use a PPP, it is most advantageous in public projects where cost overruns are unlikely. This recommendation is based on the premise that a private company should not be expected to face the public auditing process as it could jeopardize its competitive edge or be expected to operate unprofitably as this would damage relations between the GoC and defence industry.

## **Instituting an Improved Capability Development Process**

Understanding the internal dynamics of the DND/CAF, CA and Defence Industry, it is now possible to discuss how to operationalize the ideas presented in the previous chapters. This will be accomplished by providing recommendations that will streamline organization and processes. The aim of these recommendations is to enable the CA to develop a sustainable CBP process that is able to get more projects into definition and implementation with its current staff limitations.

<sup>&</sup>lt;sup>133</sup> Huanming Wang, Wei Xiong, Guangdong Wu, and Dajian Zhu. "Public-Private Partnership in Public Administration Discipline: A Literature Review." Public Management Review 20, no. 2 (2018): 293-316.

Turning the CA's conceptual work of CE and AWP into operational requirements that can be well understood by industry necessitates having both technical, contractual, and scientific expertise. Therefore, a capability development team should be comprised of members from these specialties working synchronously within the same framework. Capability development teams should be organizationally arranged into streams of capability. Figure 8 shows one approach and while the purpose of this paper is not to build a capability development structure, it is evident that CA can optimize its capability development structure to leverage its corporate knowledge. Furthermore, it should also actively try to include scientific experimentation and project procurement design earlier into the process. Understanding how capabilities will integrate into the CA portfolio should not be left solely to military members and procurement strategies should be considered as part of the capability design to prevent early trade-off discussions.

An important structural change that the CA should change is to remove the regimental structure within DLR as it promotes tribalism and is counter-productive. The CA's vision of integrated combat teams up to battlegroups necessitates a similar approach within the capability development staff. This would ensure that a broad discussion occurs regarding capability and reduces stove piping of projects. Another recommendation for the CA to consider is to increase the number of defence contractors or civilian employees working in capability development in CA staff. It would provide much needed continuity to capability development and minimize the impact of the constant turnover of military staff. Adopting this type of organization would add depth and improve corporate knowledge of the capability development teams and ensure that capability design is reflective of the CA's conceptual vision.

With the appropriate capability development teams, the CA should then consider linking CE and AWP to projects using the "knapsack"<sup>134</sup> model of capability development. Such an approach could be introduced under a "Programmes" (formerly described as Omnibus) project model as described in the PAD.<sup>135</sup> While not all projects are suitable for this approach, many CA capabilities could be grouped together. This approach simplifies and clarifies for staff the capability development process. It also allows the project team to move funding and personnel rapidly between projects in a resource constrained environment. This approach would enable the CA to take advantage of spending opportunities as they arise and manage multiple procurement schedules in a manner that considers the complete operational capability vice as individual systems.

As part of the knapsack model, it is critical that the CA also develop RAF for capability development that is based on analysis and empirical evidence to guide decision-makers. As part of force design, the CA should invest in more modelling and simulation to support this analysis. The CA should also formalize within each new grouping the defence science programs to better align their outputs with the capability development process. The RAF provides decision-makers with justified reasoning to support their decisions and also identifies where opportunities could be introduced if funding becomes available.

It is also critical for the capability development teams to also ensure that the correct project type is selected to procure the identified capabilities. Too often, the "waterfall" project type is used to procure new capabilities when it would be more appropriate to used a "phased" or

<sup>&</sup>lt;sup>134</sup> A short section was included to discuss PPP, as the governance model is discussed on professional certifications and PAD familiarization training within the DND/CAF

<sup>&</sup>lt;sup>135</sup> Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 41.

"cyclical" approach.<sup>136</sup> This is why it is critical to have a project manager as part of the capability development team earlier in the process and not later in OA to determine the project type. Utilizing a modified approach would ensure that a steady stream of integrated capabilities is delivered over the 20-year CIF.

<sup>&</sup>lt;sup>136</sup> It is important to note that the "Programmes" approach does not mean that all sub-projects are required to use a "Waterfall" approach. Department of National Defence. *Project Approval Directive v1.1.* (Gatineau, QC; National Printing Bureau, 2019), 41.

#### CONCLUSION

There is no questioning that Canadian procurement is a complex affair but the bureaucratic process, which exists to leverage DND/CAF spending to improve the Canadian economy, is immutable. So, it would behoove the CA to examine where it can improve and streamline its capability development process. If the CA were to form more efficient groupings, it could better leverage its corporate knowledge. As well, if the CA improved its modelling and simulation to build a current force structure and scenario database, it could rapidly identify capability gaps in defensible manner. Capability gaps with clear metrics would lead to better questions that could be posed to industry to shape better operational requirements. Employing a RAF would also focus the capability staff and better inform decision-makers about the true level of risk enabling swift decisions and avoiding numerous approvals from Treasury Board or MND.

Simplifying complexity is a major challenge and it will only become easier by improving corporate knowledge. Therefore, it would be sensible to adopt a multi-disciplinary capability development group that is better positioned to conceptualize, analyze and procure the "system of systems" capability<sup>137</sup> that the CA wishes to adopt. Deeper staff groupings and better corporate knowledge will ensure that design work remains constant and well informed with good scientific studies. It would also ensure that new capabilities are truly pan-CA and not reflective of each Corps/Branch.

Lastly, it is critical the capability development teams design projects smartly. Using a programme approach incorporating waterfall, cyclical or phased projects grants procurement teams more flexibility vice defaulting to the singular "waterfall" project for each of the CA's

<sup>&</sup>lt;sup>137</sup> Department of National Defence. *Advancing with Purpose: The Canadian Army Modernization Strategy*. (Kingston, ON; Army Publishing Office), 3.

projects. This approach would also increase funding agility by allowing the CA to move funding rapidly between sub-projects once PA(Def) and PA(Imp) is delegated vice having each project go to the TBS/MND for approval separately. If this approach were to be implemented, it would be possible for the CA to increase throughput and bring more well-defined capability designs through ID and OA into Def. This approach would also provide more agility to the implementer during the Def and Imp phases to procure and field capabilities.

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