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AN INVESTIGATION INTO DEFENCE PROJECT PERFORMANCE

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AIM

1. This service paper will address a topic submitted by Director Force Development (DFD) related to Department of National Defence (DND) project management:

> *"Due to the vast training and experience required to be effective in Project Management, DND is highly reliant on public servants and contractors to provide the majority of the knowledge base and expertise to progress projects. Given that, most CAF members when posted to project management positions only occupy the position for 2-3 years, should the CAF create a project management professionals career stream in order to maximize the use of project-trained CAF members and improve project management effectiveness?"*

The wording of this topic suggests that creating a project-focused career stream for Canadian Armed Forces (CAF) personnel will maximize the number of CAF personnel trained in project management and then queries whether this will increase the effectiveness [acquisition] projects. The implicit premises of this wording risk *begging-the-question* related to several issues that are best examined separately. The topic will therefore be addressed as a framing problem, in that DND / CAF leadership perceive that projects are under-performing, but the causes of this condition are not evident. To do so, the paper will build persuasive arguments to answer slightly broader questions: *Are there inherent flaws in how DND undertakes acquisition projects and if so, how are CAF personnel best employed to improve their effectiveness?*

INTRODUCTION

2. A truism in Canadian political discourse is that DND under-delivers on the procurement of military equipment, even when approved and funded within Defence policy. The reasoning typically goes, the processes related to expenditure authorities, procurement, and a myriad of Federal government constraints[1] are so cumbersome, so complicated, that they create a barrier between the good intentions of senior military leadership and the capabilities they are approved to field. As David Perry concludes in his authoritative CGAI article, to overcome this barrier, a project management occupation stream of government employees and military staff is required.[2] However, this conclusion is of insufficient detail and ignores issues lie outside the bounds of project management. For clarity, the following brief description of a generic project is provided.

3. The Chief of the Defence Staff (CDS) is explicitly charged with deciding which capabilities[3] are needed to fulfil the CAF's operational mandate. These decisions are supported by a rigorous capability based planning (CBP) process which identifies future capability gaps. In parallel, robust DND governance structures related to defence policy and available funding are used to ensure investments in Defence are affordable and aligned with national priorities. Once decisions are taken regarding which capabilities are

[1] Gender-Based Analysis +, Greening Government, Modern Treaty Implications, etc)
[2] Perry, David. Fixing Procurement Canadian Global Affairs Institute, 2016. https://www.cgai.ca/fixing_procurement
[3] National Defence, "Organizational Structure of the Department of National Defence and the Canadian Armed Forces," https://www.canada.ca/en/department-national-defence/corporate/organizational-structure.html (accessed Oct 12, 2021).

subject to investment, the sponsoring organization[4] is tasked to establish a project[5] and lead the first two phases.

4. The key outputs of the first two phases of the project are the statement of operational requirements (SOR), which details what, functionally, the delivered system must be able to do, and the business case analysis (BCA), which assesses which system(s) will best deliver the capability. The senior leaders and force development (FD) staffs who develop and approve these products are primarily officers from operational branches of the CAF[6], as they are the recognized authorities in their various warfare domains and component capabilities. Upon completion of phase 2, the scope of the project would be recognizable to a non-expert as decisions concerning what system(s)[7] will deliver the approved capability. At this point, the project goes through a major transition.

5. Upon entering the third, definition (Def) phase, a project management office (PMO) is established under ADM(Mat) while the service commander who initiated the project assumes the oversight role of Project Director (PD). During the Def phase, the PMO staff references the SOR and BCA, and using a systems engineering (SE) technique known as decomposition[8], derives the detailed set of technical requirements, for the system(s) that will be procured and integrated into the CAF. During the fourth, implementation (Imp) phase, the system(s) is/are procured, trialed and delivered to the

[4] Typically the most appropriate CAF service commander e.g. Commander Royal Canadian Navy (RCN) for conventional maritime domain capabilities.
[5] National Defence, "Defence Purchases and Upgrades Process," https://www.canada.ca/en/department-national-defence/services/procurement/defence-purchases-and-upgrades-process.html (accessed Oct 12, 2021).
[6] The operational branches of the force include Naval Warfare, Combat Arms, Air Operations, and Special Operations Forces. A branch can include more than one military occupation.
[7] A system in this context is typically a fleet of weapons, vehicles, personal equipment, etc.
[8] Steven R. Hirshorn, Linda D. Voss and Linda K. Bromley, *NASA Systems Engineering Handbook* (Hampton: NASA/Langley Research Center, [2017]). https://www.nasa.gov/sites/default/files/atoms/files/nasa_systems_engineering_handbook_0.pdf

end-user for employment. From this description we can define the essential role of CAF personnel in the delivery of new or enhanced capabilities is in defining the capability sought. In the following section, this spectrum of activities will be examined for issues that could lead to the current unsatisfactory performance of acquisition projects.

DISCUSSION

6. Project Management (PM), as practiced within DND, is aligned with the industry standard PMBOK[9] and for more than decade, most CAF personnel who work in all flavors of project have received and increasingly sophisticated PM training within a formal competency development (PMCD) framework. This approach has as a goal the professionalization of PM within the Dept. Douglas Demster describes it as

> "…a well-defined …certification programme supported by a Complex Project and Procurement Leadership (CPPL) 20-day modular programme delivered by a university. There are now 500 military and civilians with a PMCD certification at PCRA levels 1, 2 or 3. The launch in Canada of a master's degree in Complex Project Leadership in 2016 with selected government and industry candidates will provide the "Jedi Knights" needed to move the programme and shape the acquisition system for the future."[10]

If this initiative has not improved the timeliness with which new capabilities are delivered into service, it is entirely reasonable to query whether there are other factors, within

[9] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 5th ed. (Newtown Square, Penn: Project Management Institute, 2013).
[10] Douglas Dempster, "Capability Acquisition and Canadian Defence Policy: Programme Achievability and Resilience?" in *Canadian Defence Policy in Theory and Practice* (Cham: Springer International Publishing, 2019), 331-350.Dempster, Douglas. "Capability Acquisition and Canadian Defence Policy: Programme Achievability and Resilience?" In Canadian Defence Policy in Theory and Practice, 343. Cham: Springer International Publishing, 2019.

DND/CAF control which affect the situation – after all, project performance and satisfactory delivery of new capabilities to the CAF are not exactly the same thing. So, if we might momentarily hold the assumption that DND projects are in fact managed in accordance with best practices and government policy, is there any other likely root cause of the continued trend of cost overruns, schedule delays, or capabilities that do not meet end-user expectations? Indeed, what *are* end-user expectations and how are they formed?

7. PM is characterized by using "specific knowledge, skills, tools and techniques to deliver something of value to people."[11] In this context, a new capability generally involves the procurement of new piece of equipment along with enablers[12], all of which are engineered to transform generic equipment into a system that can be integrated with other CAF systems to result in a capability. Importantly, the procurement of the new equipment is almost always the most costly and publicly visible aspect of a military project and therefore, is often understood by non-experts as a proxy for the entirety of the project itself. This over-simplified view of acquisition projects is understandable but potentially harmful as is can lead to the following sentiment, even amongst experienced military practitioners: "*if only we can procure equipment X, we'll be able to field capability Y*." If this sentiment is simply the grumbling of outsiders who misunderstand the relationship between equipment and capabilities then it is not a concern. On the other hand, if this is a pervasive mentality that has traditionally affected how military leaders understand and pursue capabilities, it could lead to serious flaws in how DND projects are managed and resourced.

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[11] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK Guide)*, 5th ed. (Newtown Square, Penn: Project Management Institute, 2013).

[12] Enablers could include certain quantities of spare parts, tooling and test equipment, training materials, maintenance and trials plans, operations manuals, ammunition, etc.

Defining Scope: Systems Engineering vs. Project Management

8. To indicate where DND, as a whole, falls along this conceptual spectrum we can employ a simple heuristic. By looking at how new capabilities should *ideally* be defined and acquired, it may be possible to identify areas for improvement and of those, there may be a subset that can be positively affected by adjusting the role / employment of CAF members. Specifically, it is necessary to examine the interplay between the two areas implicated in delivering new capabilities, SE and PM.

9. The most important aspect of PM related to this argument is that, as a stand-alone area of professional practice, it is agnostic to the values, policies, processes of the organization implementing the project. All things being equal, employing PM practices within an organization might maximize the likelihood of positive outcomes for a project, but will not fix structural issues or problematic practices within an organization. At best, using rigorous PM may assist in identifying aspects of an organization that lead to poor project outcomes and hint at their solution.

10. On the other hand, SE is a practice oriented to the development of a technical solution and shares much in common with PM as a management methodology:

> "[SE] is a transdisciplinary and integrative approach to enable the successful realization, use, and retirement of engineered systems, using systems principles and concepts, and scientific, technological, and management methods."[13]

The most obvious manifestation of SE within a DND project, as mentioned, is the decomposition and management of detailed set of technical requirements from SOR,

[13] SEBoK Editorial Board, *The Guide to the Systems Engineering Body of Knowledge (SEBoK)*, ed. Cloutier R.J. (Editor in Chief)., 2.5th ed. (Hoboken, NJ: The Trustees of the Stevens Institute of Technology., 2021), 1-1155.

commonly known as the system requirements document (SRD). As a minimum, the SRD needs to be of sufficient detail and quality to enable a fair and competitive bid process and subsequently the procurement of the system identified in the BCA. However, a robust SE framework is intended to create enduring, and logically consistent linkages through the entire lifecycle of a system, from conception to retirement. Further decomposed to constrain the design of lower level system elements, used by other peripheral systems to define how different systems will interface and the need to tests and trials needed to verify and validate that the system will deliver the capability sought. The role of SE is not widely understood within DND outside of technical organizations, arguably for several reasons.

- its use varies widely depending on the technical complexity of the system being described;
- it is nested, arguably hidden, within the PM structure; and
- it is often outsourced by to either contractors embedded within the PMO, or to the vendor who is contracted to engineer the system.

These brief characterizations of PM and SE are sufficient to highlight the following important insight.

11. Regarding the possible problematic sentiment that the Dept as a whole is generally fixated on “procuring the equipment” rather than “acquiring the capability” First is that for projects delivering highly complex military systems (of systems), PM and SE serve complimentary functions with many overlapping processes but they create distinct views of the world for their practitioners. SE is the recognized methodology to ensure that the project delivers the capability sought and would ideally provide a rigorous framework informing the project management staff exactly how to deliver the capability sought. The absence of such continuity between each successive expression of a capability’s lifecycle

indicates that this is a possible problem area for projects. Specifically, there are two major dislocations along the nexus of activity between the time a capability gap is identified and when a project is delivered into service. The first happens at the handoff of the results of capability based planning and the service commander establishing the project and the second happens when the project enters definition and leadership transfers to ADM(Mat). If these dislocations are not bridged by a robust staff employing SE approach to maintaining a high fidelity mapping from capability gap, to operational requirements, to technical requirements, to verification and validation activities with a view to fully characterize the capability delivered against the original aspiration, then we are not actually doing SE and cannot expect to enjoy the benefits that such a practice enables. On the other hand, if successive echelons of staff do their best to manually reference the information provided by each preceding step to develop requirements, trials plans etc with enough rigor to justify expenditures, projects are at high risk of propagating inconsistent, ambiguous, or incomplete requirements throughout the project, and into subsequent plans and contracts. Hanumanthrao Kannan of Virginia Tech describes the impact of inconsistencies that can propagate through a project if user in the early stages of customer elicitation:

> "…proceeding with such conflicting preferences will ultimately result in no solutions, leading to the need for iterations later in the lifecycle, which results in schedule delays and cost overruns. With the provided formalism, a consistency check can be made very early in the lifecycle to ensure that solutions will exist."[14]

[14] Hanumanthrao Kannan et al., "Theoretical Foundations for Preference Representation in Systems Engineering," *Systems (Basel)* 7, no. 4 (2019), 55.

12. In this case, if the sponsoring organization does not have a sufficiently nuanced understanding of the linkages between the problematic scope and their own operational requirements, or even overall capability needs, then the project will suffer various challenges such as:

a. Schedule delays as a result of insufficient definition of scope that must be revisited, or studied independently by a third party;
b. Cost increases out of control as a result of hidden scope that only become visible once a vendor highlights requirements that do not constrain a unique engineering solution, or are contradicted by other requirements; or
c. The delivered capability is deemed not suitable by an end-user community during trials without being able it identify what specifically which requirement(s) are responsible to the apparent disconnect?

13. To summarize, DND has spent over a decade refining processes to align with governing structure and authorities and instituted a robust PM competency development framework that has seen hundreds of military and civilian employees trained in PM. Is it possible to execute high quality PM with inadequate SE? The answer is yes. If the expression of the enterprise needs are not properly defined and successively translated (decomposed) through all phased of the capability lifecycle, from conception to retirement, then there is a high likelihood that the project will enter the definition phase with major problems baked-in to the operational requirements and high-level technical requirements. As a result, when formal SE processes kick-off during the Def phase, any inconsistencies, omissions, contradictions, etc within the SOR or the logic of the BCA will be propagated throughout the project identified by skilled SE practitioners, or until they manifest as a delivered capability that does not meet user needs.

CONCLUSION

14. The paper began by asserting that the ubiquitous perception that DND requires more experienced, better trained project management professionals in order to expedite the delivery of badly needed military capabilities into the CAF may be the result of a *framing problem* where the statement of the problem serves to hide the actual root cause and thus viable solutions. The central question of the paper therefore modified to read: *Are there inherent flaws in how DND undertakes acquisition projects and if so, how are CAF personnel best employed to improve their effectiveness?* Short of a qualitative assessment of DND project performance, which is beyond the scope of the work, these questions have been addressed using heuristics. I.e. by comparing high level behaviors and processes with an idealized case where both PM and SE were fully professionalized. While this methodology cannot be considered an authoritative study, it reframes the issue in a way that can be helpful.

Inherent Flaw in DND Acquisition Projects

15. Specifically, we temporarily established an assumption that the current PM framework is an appropriate combination of industry best practice and government policy and therefore temporarily discounted the possibility that the solution was better PM (in the strict sense that the issue might not be found in the pages of the PMBOK or a Treasury Board policy). Next, by considering a common (mis)perception amongst CAF leaders that equates *capability acquisition* with *equipment procurement*, we extrapolated that mentality to identify the project area that would be most affected – scope management. An organization with a procurement-centered focus would only see value in SE practice to enable the costing and procurement of the new system. Finally, in

assessing the intended interplay between PM and SE, it is entirely plausible that current frustrations over capability delivery might actually be caused by missing or low quality steps of SE practice, even within a high quality project team, due to inconsistent or contradictorily expressions of scope.

How to Employ CAF members in Projects

16. CAF officers are trusted, to an extent, to make expert judgements about the way many capabilities will be realized. This is formalized in the way projects are established under the leadership of the appropriate service commander and continues via the role of Project Director (PD) after the project transitions to ADM(Mat). Upon reaching the Definition phase, the PM staff is dominated by CAF officers of technical occupations (and civilians of equivalent civilian classifications) who are mostly employed in defining and managing the technical scope of the project where they draw heavily on their operational experience and relationship with the operational community to resolve the technical issues of the project. While it is common for both PD and PM staff to have formal PM training, SE is not professionalized to the same extent, thus the reliance on contractor support in this area and only within the confines of the project. But hiring contractors to do this particular tranche of SE is not sufficient to resolve the larger issue. Formalizing SE training and competency within the career stream of CAF Technical Officer occupations may enable adjustments in how SE work is done, preceding the establishment of a project, with a view to improving the Dept's capacity to deliver increasingly complex and networked Military capability.

RECOMMENDATION

17. There is a compelling logic suggesting that DND is at a critical point in developing its acquisition framework[15]. Professionalization of PM has been incredibly successful at adding coherence and rigor to government processes struggling to keep pace with industry best practice. A similar approach[16] should be studied for feasibility regarding the role of CAF officers of the technical trades[17] as it related to SE along the whole spectrum of capability management, not just during Definition.

Annex: Assumptions

[16] Peter W. Beven, Luke Brown and Jo Dawson, "A Competency Model in Systems Engineering for the Australian Department of Defence," *Australian Journal of Multi-Disciplinary Engineering* 15, no. 1 (2019), 44-51.

[17] Naval Technical Officers (NTO), Royal Canadian Electro-Mechanical Engineers (RCEME), Communications and Electronics Engineering (Air) (CELE(Air)), Air Engineers (AIRE), Canadian Military Engineers (CME), etc.

ANNEX A: ASSUMPTIONS

To focus the scope of this paper, the following clarifications and assumptions are necessary.

I. The paper will refer to DND major capital projects, which fall under the mandate of ADM(Materiel) to manage and sustain. The conclusions may be applicable to projects led by the Information Management (IM) and Infrastructure (IE) groups but differences are not explicitly addressed:

II. The detailed processes behind capability management, project management, and materiel sustainment will be referred but will not be described in detail;

III. Some assertions in this paper will be underpinned by the author's experience in force development and project management to the extent they are deemed to be widely applicable / accepted within those communities of practice;

IV. The term procurement will be used only to describe the formal activities, authorities and processes, governed by the Financial Administration Act (FAA). When discussing the broader set of activities that define, deliver and integrate new military capabilities, the term acquisition will be used.

V. To focus the scope of this paper, the following clarifications and assumptions are necessary. The paper will refer to DND major capital projects, which fall under the mandate of ADM(Materiel) to manage and sustain. The conclusions may be applicable to projects led by the

Information Management (IM) and Infrastructure (IE) groups but differences are not explicitly addressed:

VI. The detailed processes and governance behind capability management, project management, and materiel sustainment will be referred insofar as they add to the central question of the paper but will not be described in detail. This paper is directed toward DND practitioners of force development and material acquisition who would be generally familiar with these areas;

VII. Some assertions in this paper will be underpinned by the author's experience in force development and project management to the extent they are deemed to be widely applicable / accepted within those communities of practice; and

VIII. The term procurement will be used only to describe the formal activities, authorities and processes, governed by the Financial Administration Act (FAA). When discussing the broader set of activities that define, deliver and integrate new military capabilities, the term acquisition will be used.

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