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ENOUGH PET PROJECTS: STEPS TOWARDS SUSTAINABLE INNOVATION

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JCSP 46

Service Paper

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CANADIAN FORCES COLLEGE – COLLÈGE DES FORCES CANADIENNES

JCSP 46 – PCEMI 46
2019 – 2020

SERVICE PAPER - ÉTUDE MILITAIRE

ENOUGH PET PROJECTS: STEPS TOWARDS SUSTAINABLE INNOVATION

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Word Count: 2,356

Nombre de mots : 2.356

AIM

1. In the next 10 years, innovation and high-technology capabilities are not a large part of the Canadian Armed Forces (CAF) portfolio[1]. The following paper discusses pragmatic improvements and the steps necessary the Director of Naval Requirements or Director of Maritime Innovation can make to the procurement and life-cycle management processes to broadly invest, initiate, procure and field emerging innovations and technologies.

INTRODUCTION

2. The CAF procurement system is designed to predictably and realistically acquire large and small complex systems for the use by the Department of National Defence (DND) while taking into account the need of various stakeholders[2]. Due to the risk involved in acquiring low technological readiness levels (TRL) systems, this process normally acquires proven designs in the upper TRL such as commercial of-the-shelf (COTS) or military off-the-shelf (MOTS) systems. Higher acquisition risks require justification and higher authorities[3] and effectively de-incentivize project teams. Low TRL projects which include emergent technologies and innovations are therefore only targeted in research and development initiatives or in demonstration activities that do not lead to sustainably fielded technology.

3. There is no existing list or plan of innovations or emergent technologies to be used by project teams unless specifically researched by the team members. The legendary management consultant Peter Drucker once said: "If you want something new, you have to stop doing something old"[4]. To broaden our acquisition base and increase the CAF's understanding of emergent technologies we need most projects to understand the application of technology and how it can be integrated into their own project instead of specific emergent technologies being actively targeted by one or two projects on a case by case basis. This broader approach will be demonstrated to be supported by innovation theory, is in place with other militaries, and can be implemented in the short horizon with minimal resources.

DISCUSSION

4. The pace of innovation and technology has admittedly surpassed our ability to procure it. Although multiple changes targeted by DND are designed to accelerate the procurement

[1] Canadian Forces College. "Research Topic Lists" (Joint Command Staff Program 46), 30/43, 2019.
[2] Department of National Defence, *Defence Investment Plan 2018* (Ottawa: DND Canada, 2018), 28.
[3] Government of Canada, "Project Complexity and Risk Assessment Tools." last accessed 24 October 2019. https://www.canada.ca/en/treasury-board-secretariat/services/information-technology-project-management/project-management/project-complexity-risk-assessment-tool.html.
[4] Goodreads. "Peter F. Drucker, Quotes" last accessed 24 October 2019, https://www.goodreads.com/quotes/420819-if-you-want-something-new-you-have-to-stop-doing.

process[5], there will continue to be a significant time delay between the identification and fielding of innovative technologies. It should be no surprise that innovation in the military context has historically been the product of significant failure or civilian interference[6].

5. The procurement process is designed to field and acquire systems and services at a predictable rate. Unless specifically targeted, the process is not designed to invest in research and development or field untested technologies. The vast majority of fielded equipment, systems and services is obtained through this standardized process through minor capital, major capital or non-capital projects.

6. Innovation in the DND context means to use or implement new methods, ideas, products and technologies. Innovation is scalable and can range from small to complete overhauls of systems and processes. Innovation in the private sector is often due to intense global competition, in contrast, innovation for the case of government organisations and militaries "depends on human imagination, motivation, and collaboration'' [7]. Innovation does not require grandiose proclamations or top down direction but has often been accomplished using limited budgets. The key is to bring together talented personnel, time and information.[8]

7. There is significant emphasis being placed on innovation by the Government of Canada[9] and this pressure affects the DND and the CAF. The current Defence Policy, *Strong, Secure, Engaged* (SSE), has created a new Innovation for Defence Excellence and Security (IDEaS) program which plans to invest and collaborate on innovative technologies and support Canadian industry in fields of emerging technologies.[10] An Assistant Deputy Minister (Data, Innovation and Analytics) has been recently created[11] and like others, the Royal Canadian Navy (RCN) is creating a directorate who will direct the Maritime Innovation Programme.[12]

8. The procurement and sustainment processes have multiple opportunities to invest or initiate innovation at the identification, option analysis, and definitions phases. An overhaul of the procurement process is impractical, however, small more pragmatic incremental changes are

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[5]Jody Thomas, *Response to Recommendation 4,7 and 8 to Report 7, Operation and Maintenance Support for Military Equipment* (Deputy Minister, 30 April 2018), 4.
[6] Barry R. Posen, *The Sources of Military Doctrine* (Ithaca, NY: Cornell University Press, 1984), 57.
[7] Rosabeth Moss Kanter, "How Great Companies Think Differently," *Harvard Business Review* 89, no. 11 (Nov 2011), p.69.
[8] Stephen Peter, Rosen. *Winning the next war: Innovation and the modern military*. Cornell University Press, 1994., 252.
[9] Geoffrey Morgan, "What happened to Industry Canada? Trudeau elevates scientific research in new cabinet role,'' *Financial Post*, 4 November 2015.
[10] Department of National Defence, *Strong, Secure, Engaged Canada's Defence Policy* (Ottawa: DND Canada, 2017), 78.
[11] The Maple Leaf – Defence Stories, "Blueprint 2020: Taking Stock of Defence Modernization." Last accessed 34 October 2019, https://ml-fd.caf-fac.ca/en/2019/01/23939.
[12]Art McDonald, *Request to Create a Directorate of Maritime Innovation*, (3371-1901-1, D Nav P&T 5/RDIMS# 443199, July 2019).

palatable and can lead to significant changes and accelerations as demonstrated by the new risk based pilot program by Public Services and Procurement Canada (PSPC).[13]

9. To capitalize on innovation is difficult, it comes from constant analysis, evaluation and hard work[14]. Given the multitude of opportunities to incorporate innovation in the procurement process, a more organic integrated process could be created vice the top-down approach. Kanter in the Harvard Business Review supports this: ‘’employees can be treated as self-determining professionals, coordinating and integrating activities and producing innovation through self-organization in addition to formal assignments’’. [15]

PROPOSAL

10. A process or system to encourage and initiate innovation from the bottom up would require multiple personnel to collaborate, share information and importantly, purchase the technology for a specific and sustainable use. To be successful, this process should be pragmatic and cause minimal change in existing processes.

11. Conceptually, innovation and technology should be considered like any other support or enabling function. It should not require a great leap of faith to compare it to an enabling function like spare parts and training. In fact, two of the main Integrated Logistics Support functions are data and computer resources[16] which in many cases, are the innovative technologies we are targeting. With this jump, we now have at our disposal the tools developed for the acquisition and sustainment of these support functions to acquire and develop innovation and technology. Therefore, the standard life-cycle management and system engineering processes, techniques, and deliverables can be used to select and purchase innovation and technology for various projects just like they are used to acquire other support functions for the project. These processes are often subject to incremental changes and are already ingrained in our procurement processes and familiar to both DND, PSPC, Treasury Board Secretariat and Innovation, Science and Economic Development (ISED) personnel. This technique is already in place with allied militaries in the United-States[17] and Australia[18].

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[13] Public Services and Procurement Canada, "Backgrounder: Piloting a streamlined approval process for defence procurements, " Last accessed 24 October 2019, https://www.tpsgc-pwgsc.gc.ca/app-acq/amd-dp/samd-dps/spamdd-sapfdp-eng.html.
[14] Drucker, Peter. *Innovation and entrepreneurship*. Routledge, 2014.p.134.
[15] Rosabeth Moss Kanter, "How Great Companies Think Differently…",73.
[16] Manual, ‘’DMO Material Logistic Manual,’’ *Australian Government Department of Defence*, 2015, 26. It should be noted that the Australian Defence Force literature on Integrated Logistic Support is significantly more up to date than Canadian Defence literature.
[17] Manual, J. C. I. D. S. "Manual for the operation of the joint capabilities integration and development system," *US Department of Defense*. Washington. DC (2012). Annex B-3.
[18] Manual, ‘’DMO Acquisition and Sustainment Manual,’’ *Australian Government Department of Defence*, 2007, 35.

12. One of these deliverables from this acquisition process is the Statements of Operational Requirements (SOR) which contains System Effective Requirements such as Safety and Health and Environmental Sustainability[19]. We could conceivably quickly add another category simply called ''Innovation and Technology''. Although innovation and technology are not true operational requirements, neither is Environmental Sustainability. The DND guide on the development of SOR indicates the Environment Sustainability requirements are "not truly a component of System Effectiveness as defined, they are identified here as important requirements for effective operation of the system by DND''[20]. Adding innovation and technology to the SOR template and guide can be done within a matter of weeks and the authority to make the change fully resides with the Chief of Force Development and the Chief of Program. This change would ensure projects delivering capabilities consider what innovation and technologies enabling their capabilities would use and is no different than the considerations required of health or environmental requirements.

13. From the SOR, the system engineering process continues further in detail in the system specification and design specification. These are then used to develop the test and trial regimes in order to validate and verify if the system performs what was required. DND knows its systems are environmentally sustainable, if they contain hazardous material, and which capability functions they deliver. This is because the laws, rules and plans which designed the systems and services are known and specifically enunciated in the procurement documentation. These are initially enunciated in the above SOR and then further developed in the lower level specifications. A project will not deliver new innovation and technology unless they were thought of by the project staff during these phases of the project or if they were retrofitted as part of a required change. If project staff aren't required to acquire state of the art technology and innovation they will select proven, MOTS and COTS technologies in order to minimize project risk.

14. Projects often find themselves in situations where they are incapable of referencing or defending a specific requirement because the need for the requirement cannot be traced back to a stakeholder or policy. This often leads to difficulties in justifying the requirement which leads to requirements being removed or changed from a ''System shall…'' to ''System should…'' statements. This language is clearly understood by industry who do not deliver systems based on what it ''should'' do. Therefore, providing innovation and technology requirements stemming from a higher level process demonstrates where the requirement came from and why it is important. Another benefit of having innovation and technology requirements in the specifications is the costing and risk processes will consider it which will limit the amount of project unknowns.

[19] Template, ''SOR Template,'' Department of National Defence, Canada, 2014, 6.
[20] Guide, ''Guidance to the Statement of Operational Requirements,'' Department of National Defence, Canada, 2006, 8.

15. A few years ago, generating a list of innovation and technologies for systems and services would have been difficult. However, today multiple innovation teams exist throughout DND which survey the landscape and a ‘’innovation battle rhythm’’ is beginning to take form. The RCN has recently moved to create an Innovation Directorate[21] which will be the innovation lead for the RCN. However, these teams have limited resources to purchase such innovation and technology beyond the demonstration stage. However, as supported by innovation theory, through collaboration and sharing of information, these teams could provide this information to project teams as part of the ‘’innovation battle rhythm’’. Although their nascent responsibilities and authorities are not yet clear, one would expect they will be speaking with sailors and DND personnel about their own personal innovative ideas, speaking with the innovation centers of excellence under the IDEaS program and liaising with other innovation teams within DND and ISED. This has the potential to position these innovation teams to both articulate and develop strong use cases for innovation and emerging technologies in the form of requirements for the project staff.

16. Work completed in this manner formalizes the process and begins to generate base knowledge on a wide array of emerging technologies throughout DND and the CAF. Annex A contains some examples of requirements which should illustrate the output of the process. As an example, a project could request a percentage of valve bodies be additively manufactured vice cast and machined. This is relatively new technology which a project would unlikely pursue due their lack of knowledge in the domain. However, by mandating some innovation and technology, the project could select additive manufactured valves for installation on the system. This small requirement has a follow on effect in incentivizing industry to create a base load in this technology.

17. Given the speed of technology and innovation, this knowledge cannot be housed in a document but must be housed on a live database or website accessible by both innovation teams and project staff. MS SharePoint or an intranet website are the most likely candidates to host such a database. Such a database can periodically be exported for industry use. At the most innovative end of the spectrum, such a database could be linked to a DND/CAF innovation app for use by personnel.

18. Since the innovation and technology aspect of the project is not the main goal, its addition is not a significant risk factor. If the innovation and technology proves incapable of delivering as promised it can be waived, removed from the requirements or incorporated at a later date. If done correctly, the new technology won’t be part of the critical path or could be replaced by more proven technologies.

[21] Scott Shortridge, ‘’DMI Brief to Director Naval Requirements,’’ (OTT_PKS-$442752-v1, 25 January 2019).

19. The alternative is retrofitting advanced technologies which is often difficult and may be impossible as the data or interface required is often non-existent.

CONCLUSION

20. By treating innovation and technology like other system requirements it can be easily integrated into existing processes and procedures. Ease of integration will reduce resistance and accelerate adoption of the new process and more importantly provide new technology to personnel in the near future.

21. By adding small requirements to develop and acquire innovation and emerging technologies to most projects, the CAF will broadly invest in research and development in Canada. This will increase DND personnel awareness of the innovations and technologies available and develop a more in-depth knowledge about its use and application for fielded systems and services.

22. This flexible and agile process can provide a variety of requirements and can be tailored to suit the different needs of projects of all sizes. This process can apply to both physical systems and contracted services.

23. By immediately mandating innovation and technology requirements, the normal procurement cycle will deliver and field emerging technologies in two to five years and will continue to do so until specifically requested otherwise. Although not all projects are well suited for this process, some minor capital projects, all major capital projects and all non-capital projects over 20 million[22] have the potential to adopt innovation and technology requirements.

24. The function of surveying, case use development and requirements formulation can easily be exported to an external partner. These trusted companies who are not competing for procurement or sustainment contracts are sometimes referred to as tier zero contractors or companies and should not be financially incentivized to support specific technologies or innovations. This exportation of the process would reduce DND human resources.

25. Another benefit would be output of the innovation battle rhythm itself. This data set could be shared with industry on a routine bases to garner feedback and provide them with situational awareness.

26. ‘’Innovation is a team effort ‘’[23] this process is pragmatic, requires little change, and adds little risks to projects. It leverages collaboration, imagination and integration, the key

[22] This is the threshold where projects require an additional sustainment business case analysis and marks a logical benchmark or project scope.
[23]Gen Stanley McChrystal, Tantum Collins, David Silverman, and Chris Fussell. *Team of teams: New rules of engagement for a complex world*. Penguin, 2015. p.vii.

characteristics of innovative organisations as recommended by authors on the subject. This process could conceivably be started tomorrow and generate deliverables within a few months.

RECOMMENDATION

27. The following recommendation would lead to the delivery of innovation and emerging technologies to DND and CAF personnel:

a. Develop an innovation battle rhythm which ensures innovation and emerging technologies are surveyed, their use cases developed, and their application and requirements documented;

b. Create and update a DND or CAF Innovation Capability Plan for use by projects and sustainment staff;

c. Provide a live database of innovation and emerging technologies, their use cases and requirement statements in an interactive database format; and

d. Mandate a minimum amount of technology and innovation in all projects of a certain size.

ANNEX A: Example Requirement Statements

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Annex A Innovation and Technology Requirements

ID	Statement	Rationale	Notes
INO-001	System shall use Artificial Intelligence or machine learning to identify voice commands	AI and machine learning are the superior techniques to understand human languages and accents	
INO-002	XX% of system parts shall be designed and manufactured using additive technologies	Retrofitting additive manufacturing is difficult. Initial design with the technology in mind provides greater options to manufacturer	Example Link
INO-003	The Project training system shall use augmented reality.	This will reduce training costs and provide a wider range of scenarios	
INO-004	System shall have an interface to a secure environment where third party applications can be hosted.	Creates the ability to host in a secure environment software developed by third parties.	
INO-005	Machine learning algorithm shall be used to optimize efficiency	Through an iterative process, machine learning algorithm can redesign, test and optimize systems for efficiency, weight, esthetics, etc.	Example Link
INO-006	System shall be Type certified	This requirements allows industry to certify the performance of the system by a third party and prevents DND from having to certify the performance.	This is an example of an innovative aspect of a service requirement. This is often used with the airplane components but never used in the maritime context